California State Mussel Watch
1983 - 84

CALIFORNIA STATE MUSSEL WATCH
MARINE WATER QUALITY MONITORING PROGRAM
1983-84

STATE OF CALIFORNIA
WATER RESOURCES CONTROL BOARD

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Abstract

The California State Mussel-Watch (SMW) program for 1983-84 involved monitoring

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FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The reader of this report will find four distinctive criteria used to evaluate the findings presented. Findings are compared to:

- o U. S. Food and Drug Administration (FDA) alert levels, which were established for the protection of human health. The FDA has established alert levels for methyl mercury, aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, and PCBs in shellfish (mussels). If these alert levels are exceeded in shellfish taken commercially, FDA will remove them from commerce.

- o National Academy of Sciences (NAS) guidelines for the protection of predator species.

- o Median international standards set by other countries for the protection of human health.

- o A cumulative ranking of all concentrations of a particular metal or synthetic organic substance which have been found to date by SMW. That value which exceeds 75% of all measurements (the upper quartile value) was arbitrarily defined as the ETPL 75 or 75% ETPL value, where ETPL stands for Elevated Toxic Pollutant Level. The words "elevated" and "somewhat elevated" are often used herein to describe concentrations at the ETPL 75 level. Similarly, the upper decile value was denoted as the ETPL 90 or 90% ETPL value. The words "very elevated" and "highly elevated" are often used herein to describe concentrations at the ETPL 90 level. It should be clear that this internal ranking concept bears no direct relation to adverse impacts on public health and the aquatic environment. The ETPL concept is used along with extablished standards, where available, to determine those locations that are exhibiting unusual levels of pollutants in mussels and to guide investigative and regulatory action.

In evaluating the findings in this report, the reader must distinguish among these criteria as they are used for comparing results. The first two criteria provide definite benchmarks against which findings can be judged. The third criterion provides a comparison against the values other countries have established to protect human health. The fourth criterion provides a comparison against our previous California experience in detecting a given substance.

COASTAL REFERENCE STATIONS

Monitoring at long-term coastal reference stations continues to provide a good indication of baseline conditions at a very modest cost and should be continued. It is interesting to note, however, that for each reference station, concentrations of certain substances are consistently elevated, occasionally above ETPL 75 levels. While natural causes can be inferred for most such instances, it is obvious that pollution from a wide range of human activities has reached and influenced conditions even at these more remote measuring stations.

ELEVATED SILVER LEVELS

The SMW program consistently measures elevated or highly elevated levels of silver in mussels in the vicinity of municipal wastewater outfalls. However, there have been no definite indications of adverse environmental impacts from these elevated levels. It appears that improved source control measures and/or Regional Board regulatory activities may be efficacious in reducing such concentrations. SMW monitoring should be continued in areas such as Crescent City, Redwood City, and Carmel Bay, where particularly high levels have been found. The use of freshwater clams in the Carmel River to isolate the source - if different from the outfall - is recommended beginning in 1985.

HUMBOLDT BAY

Transplanted mussels at various locations throughout Humboldt Bay have exhibited elevated levels of pentachlorophenol (PCP), tetrachlorophenol (TCP), alpha hexachlorocyclohexane (alpha-HCH), and chromium which are of concern, although there are no NAS or FDA criteria to compare to. SMW monitoring in Humboldt Bay should be intensified to define areal patterns of pollution and to help define source areas, working with the North Coast Regional Water Quality Control Board. If regulation of sources can be accomplished, a long-term SMW follow-up monitoring program at reduced intensity will be needed to determine if levels reduce correspondingly.

SAN FRANCISCO BAY

Mussels transplanted in San Francisco Bay showed elevated levels of cadmium, chromium, zinc, mercury, endosulfan, dieldrin, and gamma-HCH in their tissues in relation to other areas of the State. There appears to be a gradient for most substances of increasing concentrations in the South Bay. This may be explainable by currents and flushing, as the source of certain of these substances may be outside the immediate Bay watershed. Future SMW monitoring in the Bay should be closely related to commercial, industrial and maritime/naval activities to try to define source areas for these and other pollutants of concern.

MOSS LANDING HARBOR DRAINAGE

Both resident and transplanted mussels, fresh-water clams, fish, and sediment sampled in the drainage area of Moss Landing Harbor continue to demonstrate elevated levels of endosulfan, DDT, and toxaphene, although no FDA or NAS criteria have been exceeded. The 1983-84 samples also detected elevated levels of dacthal in this area for the first time. Watsonville Slough, the Old Salinas River, the Yacht Harbor near the mouth of Elkhorn Slough, and Espinosa Slough had the highest concentrations of these pesticides. Sufficient SMW and related monitoring has occurred to adequately demonstrate that, even though NAS and FDA criteria have not been exceeded, this general area exhibits some of the highest levels of a number of pesticides found statewide. It is also evident that intensified effort in this area would help to better define the total area affected. Results to date have provided enough information to enable the Central Coast Regional Water Quality Control Board, the California Department of Food and Agriculture, the Monterey County Agricultural Commissioner, and the Monterey County Department of Health to begin a joint effort, in cooperation with the SMW program and Toxic Substances Monitoring program, to examine agricultural pesticide use, storage, and disposal practices in order to develop improved practices which will result in the release of less pesticide residue to the aquatic environment in this area.

MONTEREY HARBOR

Lead concentrations in mussels in the vicinity of Monterey have been shown to increase as one approaches the old cannery row and the Harbor. Mussels often had lead concentrations exceeding the ETPL 90, and mussels obtained within the Harbor contained by far the highest lead levels ever measured by the SMW program. There are no U. S. FDA standards for lead in shellfish, but the levels found exceeded shellfish lead standards set by all other countries. A public health problem was perceived by local health authorities to exist in the Harbor area. Based on the SMW results, the Monterey County Department of Health posted the Harbor area in 1984 warning against the harvest and consumption of shellfish from the area. A special study of the problem was authorized by the Legislature and will be reported in a special SMW report in 1985.

Measurements made to date strongly implicate a deposit of lead-bearing slag or ore contiguous to the shoreline of the Harbor as a major source. A less complex, although NAS and FDA criteria where not exceeded. Elevated chromium concentrations were more widespread in 1983-84. PCB 1248 was detected for the first time in 1983-84. Elevated PCB concentrations were found near the mouth of the Dominguez Channel. DDT remained elevated near the mouth of Dominguez Channel. The clean up and abatement order issued to Montrose Chemical has not been in effect long enough to have resulted in any decline in DDT levels in the Harbor. Because the waterways in the Harbor are very complex, SMW monitoring should continue and should explore all areas of the Harbor to define pollutant levels before any attempt is made to focus on sources and control actions. It is recommended that the Regional Board investigate the possibility of a recent source of PCB 1248 in the Harbor area or vicinity.

ANAHEIM BAY

Levels of cadmium, manganese, mercury, lead, zinc, DDT, chlordane, dieldrin, toxaphene and other substances were found to be significantly higher in the Huntington Harbour portion of the Bay than in the northern portion of the Bay. Levels of pesticides found were elevated compared to most other areas of the state. This drainage area should be explored in much more detail beginning in 1985 as there are significant parallels with the Newport Bay situation just to the South. SMW activities should be coordinated with those of the Santa Ana Regional Water Quality Control Board, which should consider beginning followup studies in 1985-86 or 1986-87.

NEWPORT BAY

Transplanted mussels from Newport Bay showed elevated levels of cadmium, copper, lead, mercury, manganese, zinc, chlordane, DDT, gamma-HCH, heptachlor epoxide, toxaphene, and PCBs at various locations within the Bay. PCB 1248 and 1254 levels in the Rhine Channel area were especially high, along with cadmium, copper, lead, mercury, zinc, chlordane, DDT, heptachlor expoxide and toxaphene. DDT concentrations were the highest measured in transplanted California mussels statewide by SMW in 1983-84 at Bay Island and Pacific Coast Highway bridge.

Results of whole body analysis of fresh water fish obtained from San Diego Creek under the TSM program confirmed these results as they showed the highest DDT and toxaphene levels ever measured by that program, as well as elevated levels of chromium, lead, zinc, chlorpyrifos, dacthal, endosulfan, chlordane, and PCB 1254. Thus, San Diego Creek is evidently a major carrier of several toxic substances which are being found in Newport Bay.

It is recommended that the study of Newport Bay be intensified and continued, in cooperation with Regional Board efforts, to better define the more critical problem areas and constituents and to try to determine the sources of these pollutants, several of which have been banned by EPA for general use.

MISSION BAY

At various locations within Mission Bay, transplanted mussels exhibited elevated levels of aluminum, cadmium, lead, zinc, chlordane, aldrin, dieldrin, and chlorbenside. Highest levels were generally found in the Hilton Dock and Fisherman's Channel areas. As Mission Bay experiences major water-based recreational activity, it is likely that boating activities may be the cause of metal pollution. Pesticides pollution is undoubtedly originating in present and former agricultural areas of the watershed contributing flows to the Bay. Water circulation patterns may be influencing areal distribution of these pollutants within the Bay. It is recommended that exploratory SMW activities continue in order to more accurately define the extent of the problem before extensive followup source control activities are undertaken by the San Diego Regional Water Quality Control Board.

SAN DIEGO BAY

SMW monitoring in San Diego Bay has been operating at an intensive level for several years. Results to date, including 1983-84 monitoring, have shown at least four distinct problem areas and types within the Bay.

Mussels transplanted near the mouth of the 60-inch storm drain which discharges into East Basin had a combined PCB 1248 and 1254 concentration of 19,000 ng/g, dry weight, which is equivalent to 2 ppm wet weight, which equals the U. S. Food and Drug Administration tolerance for PCBs in fish or shellfish. The Regional Board is currently undertaking followup surveys to determine and abate the source(s) of the extremely high PCBs. While the levels of PCBs found in mussels are not necessarily indicative of concentrations found in fish, which are higher in the food web, enough evidence of contamination exists to justify a survey of PCB levels in fish in San Diego Bay by the Department of Fish and Game or the Department of Health Services.

The trend of elevated silver levels near Point Loma continued in 1983-84 with a finding of elevated silver concentrations at Zuniga Jetty. It is concluded that there is a source of silver in the vicinity of Point Loma.

Mussels were transplanted along the north shoreline of North Island for the first time because of the extensive historical and current U. S. Navy activities there. Although it is too early to provide definitive results, elevated levels of copper, lead, mercury, zinc, and PCB 1248 were found. Monitoring should be continued in this area as all of these pollutants could be the result of military activities.

Previous SMW monitoring had pinpointed the 24th Street Marine Terminal ore transfer facility as the cause of elevated levels of copper, lead, and zinc in the area. The 1983-84 SMW monitoring in this area shows continued high levels of these metals, despite the Regional Board's followup source control and cleanup efforts in conjunction with the operators of the ore transfer facility. It may take several years before levels begin to decline as a result of improved ore handling procedures. Monitoring should be continued to assess the rate of return of conditions to "normal".

IMPERIAL BEACH/TIJUANA RIVER AREA

The SMW began monitoring in this area in 1982-83. In 1983-84, transplanted mussels offshore of the mouth of the Tijuana River and resident mussels from Imperial Beach pier both had somewhat elevated levels of silver. Further SMW monitoring is warranted to better define the situation. However, there is no evidence through 1983-84 to indicate any significant pollution in this area from toxic substances reaching the marine environment.

1.0 INTRODUCTION

1.1 BACKGROUND

The California State Mussel Watch (SMW) is a long-term annual marine coastal, bay and estuarine water quality monitoring program administered by the State Water Resources Control Board (State Board). Actual sampling and analysis are performed under contract by the California Department of Fish and Game. The Mussel Watch Program provides the State Board and the six coastal Regional Water Quality Control Boards (Regional Boards) with an indication of geographical and temporal (year-to-year) trends in toxic pollutants along the California coast. For this purpose, the program utilizes the common Bay mussel, Mytilus edulis, and the California mussel, M. californianus, to serve as indicators and integrators of selected toxic pollutants such as trace metals and synthetic chemicals in marine waters. This annual report, fifth in a series, presents the findings of the SMW monitoring program between July 1983 and June 1984 (FY 1983-84).

The SMW began in 1977 and has continued on a yearly basis since that date. Monitoring activities performed during the first six years (1977-1983) involved the following types of sampling and resulted in these State Board reports:

- 1977-1979: Baseline monitoring of resident mussels for trace metals, synthetic organic compounds, and petroleum hydrocarbons at thirty-one coastal sites and six bay/estuarine locations.

  Report: California State Mussel Watch, Water Quality Monitoring Report No. 79-22, SWRCB, Volumes II-IV.

- 1979-1980: Continuation of baseline monitoring with increased coverage of bay/estuarine areas utilizing resident and transplanted mussels.

  Report: California State Mussel Watch, Water Quality Monitoring Report No. 80-8, SWRCB, 1 Volume.

- 1980-1981: Continuation of baseline monitoring in bay/estuarine areas and at twelve coastal reference stations; initiation in five areas of site-specific surveys dealing with previously identified potential problems related to elevated toxic pollutant levels.

  Report: California State Mussel Watch: 1980-81, Water Quality Monitoring Report No. 81-11TS, SWRCB, 1 Volume.

- 1981-1983: Continuation of baseline monitoring at six coastal reference stations and expansion of the site- specific surveys to ten areas in order to deal with previously identified potential problems related to elevated toxic pollutant levels.

  Report: California State Mussel Watch: 1981-1983, Water Quality Monitoring Report No. 83-6TS, SWRCB, 1 Volume.

Mussels have been shown to be efficient bioaccumulators of many toxic substances in their water environment. Further, the sessile nature of mussels, whether native or transplanted, permits a time integrated sampling of pollutants at one location. The merits of employing mussels as water quality indicators are well established in the scientific literature, previous SMW reports, and other scientific publications. See Appendix D for further discussion of the use of mussels as indicator organisms.

The early phases of the program in 1977-1979 were devoted primarily to the identification of baseline concentrations of selected toxic substances in mussels collected from coastal and bay/estuarine areas of California. In 1977-78, approximately thirty-one coastal stations, located largely in Areas of Special Biological Significance (ASBS), were sampled twice annually and analyzed for selected toxic pollutants. The ASBS were selected as monitoring sites because they generally represented coastal marine areas that were outside the direct influence of point source discharges (SWRCB, 1979). In subsequent years of monitoring, increased emphasis was devoted to bay/estuarine sites in order to define baseline conditions in those areas. Routine monitoring of the coastal area for the purpose of following spatial or geographical trends in pollutant levels was discontinued for many coastal areas but has been maintained at six coastal reference stations. In addition, sampling was reduced to a once-annual collection in 1979-80, based on a review of the 1977-1979 data (twice-annual sampling) and the recommendations of Goldberg, 1980.

By early 1980, sufficient geographical and temporal information on the trends and patterns of toxic substances in resident coastal mussels had been developed by SMW to satisfy one of the initial program objectives, i.e., establishment of baseline conditions (See Section 1.2). In the initial three years of monitoring, SMW was also able to identify potential problem areas along the coast and in bays and estuaries where relatively high levels of toxic substances were detected in mussels. While formal criteria were not available to distinguish these areas from cleaner areas, sufficient SMW data representing a wide variety of marine water quality conditions along the coast were available to permit identification of potential problem areas. These identifications were based on statistically significant differences in pollutant concentrations. Therefore, the SMW developed into a systematic "problem flagging" tool, basing problem area designations on internal comparisons of the SMW baseline data. The SMW program has evolved concurrently in the two areas of baseline monitoring of the coastline using resident mussels and of intensive monitoring of specific areas using primarily transplanted mussels.

1.2 PROGRAM OBJECTIVES

The goal and objectives for the State Board's Marine Monitoring Program were established in 1977 at the time of SMW program implementation, as follows:

Goal: To document and assess long-term trends in selected indicators of the quality of coastal marine and estuarine waters.

Objectives:

- Determine the baseline conditions relating to the range of normalcy in water, sediment, and biota in designated ASBS.

- Document concentrations and long-term trends of persistent substances, including trace metals and organics, in biota from marine/estuarine areas outside the vicinity of known pollutant point sources.

- Document background concentrations of petroleum hydrocarbons in biota from marine/estuarine areas outside the vicinity of known pollutant point sources.

- Establish a reference collection and storage bank for biological tissue samples to permit analyses of historic samples for hazardous substances.

- Document concentrations of trace metals, organics, and petroleum hydrocarbons in sediments from areas where suppplemental data collection is necessary and feasible, and, as required, establish a reference collection and storage bank for sediment samples.

- Provide the State and Regional Boards with credible and compatible coastal data on ambient marine water quality that are compatible with data collected by other monitoring programs.

While SMW alone has not completely satisfied each of the objectives, the overall efforts of the State and Regional Board's marine water quality programs have addressed a majority of these items. In addition, since development of these objectives in 1977, new priorities have developed as a result of enhanced knowledge of marine water quality. The most significant modification has occurred in the SMW focus on problem areas, rather than the "clean" sites, such as ASBS. This current emphasis on problem areas has resulted in a stepwise progression of baseline monitoring to generalized problem area identification to site specific problem surveys. As all of these phases are continuing concurrently, it is anticipated that newly identified problem areas will be added as older problems are resolved and/or deleted from the active monitoring program.

1.3 PROGRAM ACCOMPLISHMENTS

The following specific accomplishments demonstrate the general progress of SMW since 1977. The program has:

- Established an extensive data base which describes baseline conditions in coastal, bay and estuarine areas with regard to trace metal and synthetic organic pollutant contaminants in mussels.

- Identified at least eight areas where one or more toxic pollutants are contaminating mussels to levels of concern.

- o Demonstrated the feasibility of using mussels as indicators of toxic pollutants in marine areas.

- o Demonstrated the feasibility of using freshwater clams as indicators of toxic pollutants in the inland waters of estuaries.

- o Demonstrated the feasibility of using transplanted caged mussels for monitoring bay/estuarine areas where suitable resident mussels were unavailable.

- o Clarified the importance of following a standardized state-of-the-art sampling and analytical protocol.

- o Encouraged expansion of mussel watch type monitoring by other entities responsible for water quality control activities, including NPDES monitoring in the North and Central Coast Regions, Secondary Treatment Waiver (301h) Demonstration Monitoring mandated by US EPA, and county health department shellfish surveys (Orange County).

- o Assisted Regional Water Quality Control Boards in taking water quality control actions, including:

  North Coast Regional Water Quality Control Board to control discharge of silver to Humboldt Bay and to the near shore waters of Crescent City, to alleviate concern for widespread PCB contamination at Fort Bragg, and to confirm the likelihood of the accumulation of a wood preservative in Humboldt Bay mussels.

  San Francisco Bay Regional Water Quality Control Board to abate a small silver discharge in the vicinity of Redwood Creek.

  Los Angeles Regional Water Quality Control Board and US EPA to issue a Clean Up and Abatement Order to Montrose Chemical Company for discharge of DDT products to Los Angeles/Long Beach Harbor via Dominguez Channel.

SMW data are currently being used by the Regional Boards as a basis for pursuing special follow-up studies that may lead to water quality control actions. Studies underway to date include:

- o North Coast Regional Board's study of possible pentachlorophenol release to Humboldt Bay.

- o Central Coast Regional Board's study of pesticides in the Moss Landing drainage and lead in Monterey Harbor.

- o Santa Ana Regional Board's study of pesticides in the Newport Bay drainage.

- o San Diego Regional Board's study of PCBs, copper, silver, and zinc in San Diego Bay.

SMW will continue to cooperate with the Regional Boards in these and other efforts during the upcoming monitoring years.

2.0 SAMPLING AND QUALITY ASSURANCE PROCEDURES

SMW monitoring during 1983-84 used the same basic procedures employed in previous years (1977-83). However, the station configurations at some of the sampling locations have been changed, and freshwater clams (Corbicula fluminea) have been used as a monitoring tool in the inland portion of the Moss Landing Drainage Area (See Section 3.3.5). The protocol, which covers all aspects of SMW sampling and chemical analytical procedures, is presented in Appendix D. A discussion of those aspects of the program that are subject to annual modification, such as station configuration, sample type (resident or transplanted mussels), and ongoing quality control and laboratory intercalibration is presented in this chapter. SMW samples were analyzed for the trace metals and synthetic organic compounds listed in Table 1.

In this report, trace metal concentrations are expressed scientifically on a dry weight basis as micrograms/gram (ug/g); these values are equivalent to parts per million (ppm). Synthetic organic concentrations are expressed on a dry weight basis as nanograms per gram (ng/g); these values are equivalent to parts per billion (ppb). This is consistent with their treatment in previous

TABLE 1. Synthetic organic compounds and trace elements analyzed by SMW and their approximate detection limits on a dry weight basis.

Compound	Detection Limit (ng/g)	Compound	Detection Limit (ng/g)
aldrin	0.5	ethion	8.4
benefin	2.8	fenitrothion	3.4
HCH-alpha	0.3	fonofos (Dyfonate)	2.4
HCH-beta	1	heptachlor	0.5
HCH-gamma	0.4	heptachlor epoxide	0.9
HCH-delta	0.7	hexachlorobenzene	0.5
carbophenothion	8	methoxychlor	15
CDEC (Vegedex)	2.5	mirex	1.3
chlorbenside	2.5	nitrofen (TOK)	3.7
cis-chlordane	1	cis-nonachlor	1
trans-chlordane	1	trans-nonachlor	1
chlordene-alpha	1	oxychlordane	1
chlordene-gamma	1	pentachlorophenol	4
chloroneb	13	parathion	5
chlorpyrifos	2.1	parathion methyl	3
dacthal	1.7	PCB 1242	10
op'DDE	3.5	PCB 1248	10
pp'DDE	2.5	PCB 1254	10
op'DDD	5	PCB 1260	10
pp'DDD	3	PCNB (quintozene)	0.7
pp'DDMS	12	perthane	66
pp'DDMU	5	phenkapton (Kapton)	11
op'DDT	3	phorate (Thimet)	28
pp'DDT	4	ronnel	1
diazinon	23	strobane	50
		tetrachlorophenol	5
dichlofenthion	3.5	tetradifon (Tedion)	10
dicofol (Kelthane)	28	toxaphene	60
dieldrin	1	2,4-D isopropyl ester	36
endosulfan I (Thiodan I)	1	2,4-D isobutyl ester	36
endrin	6	2,4-D n-butyl ester	46

Trace Element	Detection Limit (ug/g)	Trace Element	Detection Limit (ug/g)
aluminum	0.8	manganese	0.08
arsenic	0.57	nickel	0.08
cadmium	0.008	selenium	0.04
chromium	0.03	silver	0.002
copper	0.04	titanium	0.09
lead	0.006	zinc	0.4
mercury	0.01		

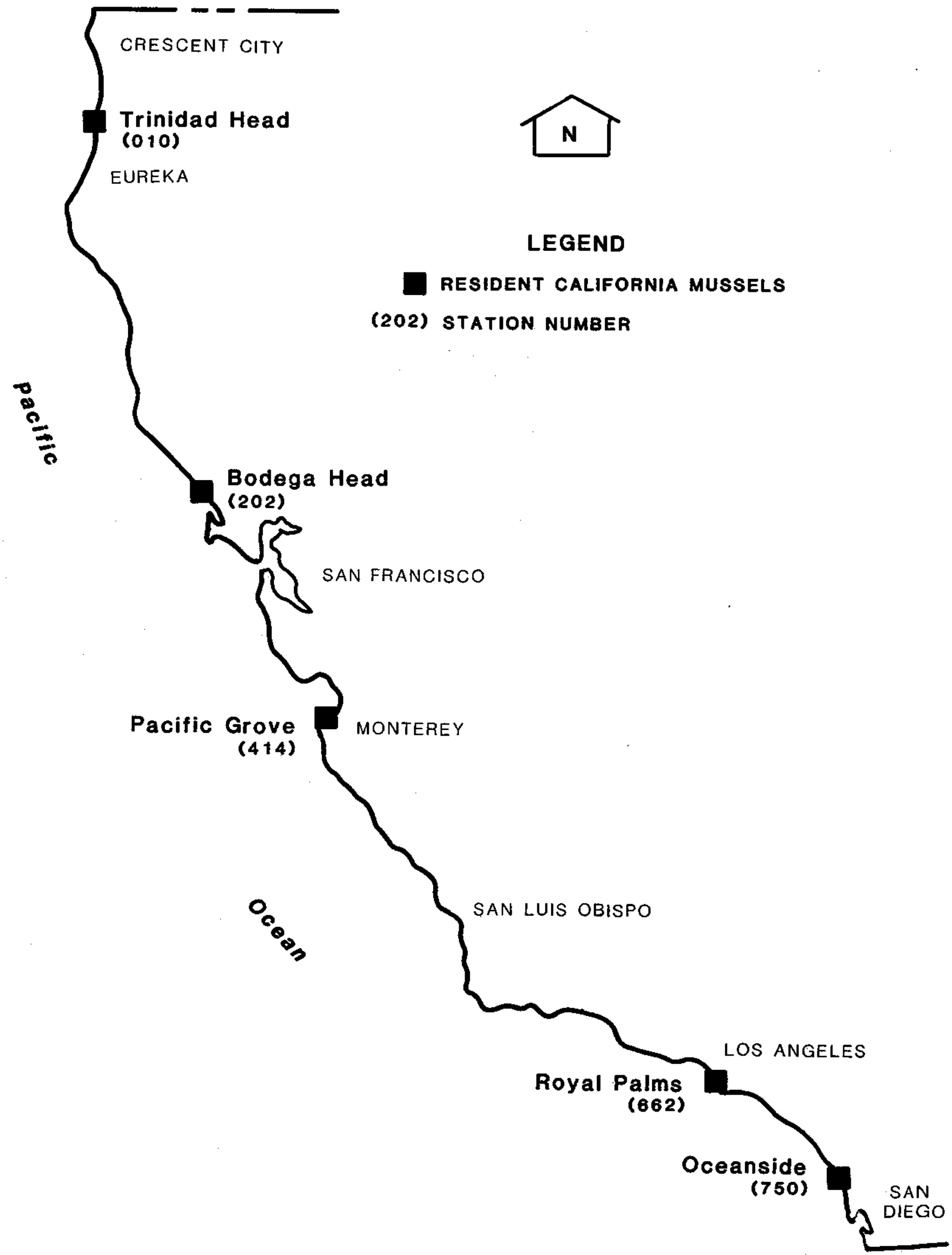

Figure 1. 1983-1984 SMW REFERENCE STATIONS

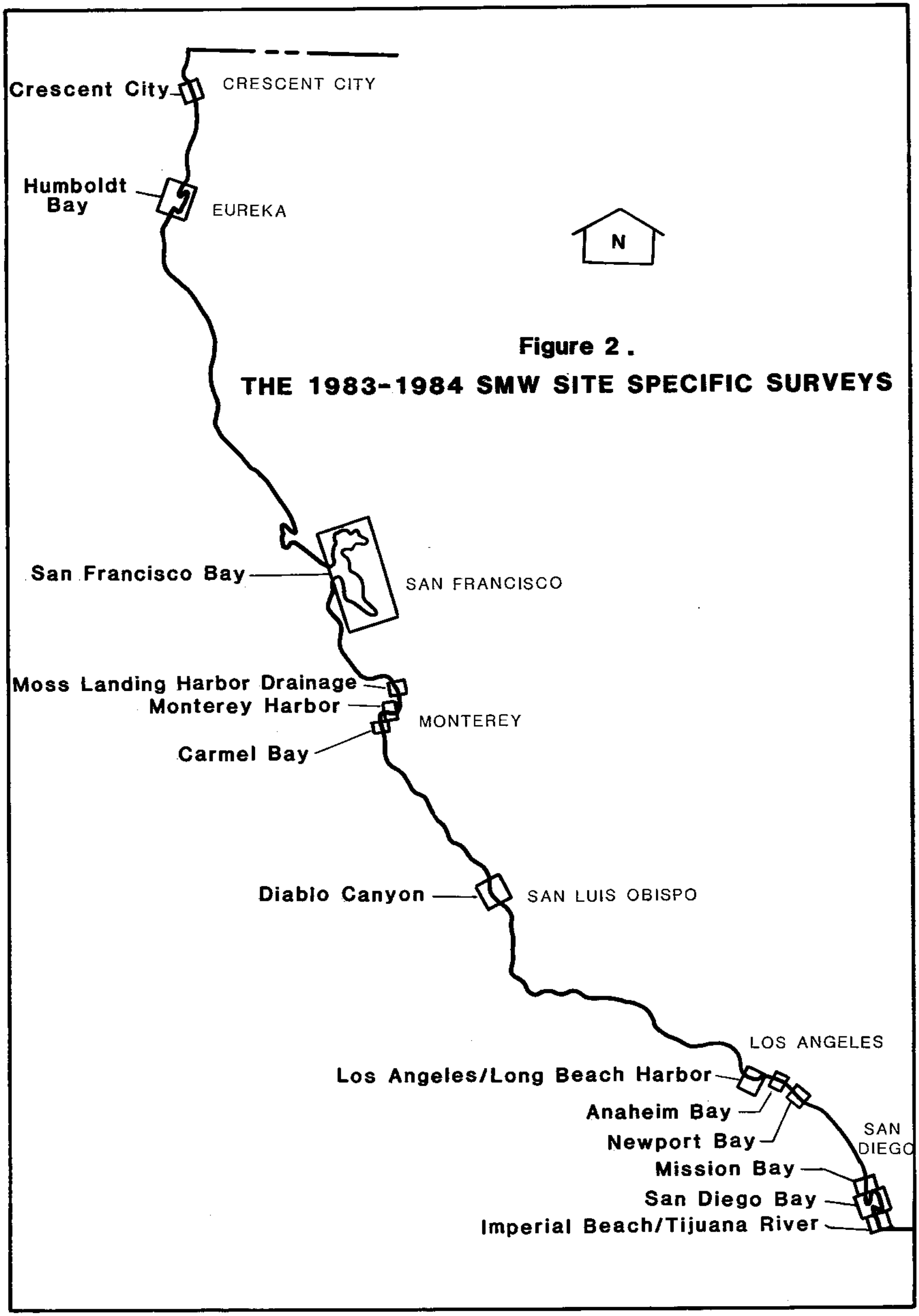

Figure 2.
THE 1983-1984 SMW SITE SPECIFIC SURVEYS

2.1.2 SITE SPECIFIC SURVEYS

Site specific surveys involving multiple station networks were performed in response to requests for monitoring under National Pollutant Discharge Elimination System (NPDES) permit requirements, or to investigate potential problem areas for specific pollutants. The Crescent City, City of Eureka, Carmel Sanitary District, and Diablo Canyon Nuclear Power Plant surveys were all performed by SMW under reimbursable contracts in response to NPDES permit requirements established by the responsible Regional Boards. The Anaheim Bay survey was performed in part under a reimbursable contract at the request of the United States Naval Weapons Station at Seal Beach. The remaining surveys were implemented as a result of SMW findings from previous years which had "flagged" the areas as potential problems. The survey areas, number of stations, sample type, and purpose of each survey are shown in Table 2.

Table 2. 1983-84 State Mussel Watch Site Specific Surv

2.2 QUALITY ASSURANCE

To ensure that SMW results are reliable, a quality assurance program is followed for field sampling, sample preparation, and chemical analyses (Appendix D). Adherance to a standardized protocol is essential so that comparisons can be made between years and between different mussel watch programs. Quality assurance for chemical analyses concentrated on trace metal analyses using U. S. National Bureau of Standards (NBS) oyster reference material. The results of the analysis are presented in Table 3. SMW analytical results for the NBS oyster material closely agreed with the accepted values.

Table 3. A Comparison of Trace Metal Results With National Bureau of Standards (NBS) Quality Control Sample

NBS	Oyster[1]	SMW[2]	NBS	Oyster[1]	SMW[2]
Ag	0.89 (0.09)	0.82 ppm (0.06)	Hg	0.057 (0.015)	0.063 (0.030)
Al	NA	105.66 (3.78)	Mn	17.5 (1.2)	15.78 (0.74)
As	13.4 (1.9)	12.5 (0.7)	Ni	1.03 (0.19	1.56 (0.40)
Cd	3.5 (0.4)	(3.42) (0.11)	Pb	0.48 (0.04)	0.464 (0.073)
Cr	0.69 (0.27)	0.39 (0.05)	Se	2.1 (0.5)	1.7 (0.4)
Cu	63.0 (3.5)	60.17 (2.68)	Zn	852 (14)	860.7 (26.7)

NA=Not analyzed
SMW=State Mussel Watch

1 - Mean concentration (ug/g dry wt.) (top number) and 95% of tolerance limits (bottom number) in parenthesis

2 - Mean concentration (ug/g dry wt.) (top number) and standard deviation (bottom number) in parenthesis

3.0 DISCUSSION OF RESULTS

Table 4 presents the results of the 1983-84 State Mussel Watch Program. These results are discussed in the following sections of this report. The reader is again cautioned that the words "elevated", "highly elevated" or "very highly elevated" appear often in the discussions, and were used in a comparative sense only. Except where specific adopted guidelines or standards are available, the comparison was an internal one, using the ETPL ranking concept to compare a specific data value with the range of values for that substance found since inception of the Mussel Watch program. Thus, "elevated" concentrations described in this report have a value primarily to the State and Regional Boards in highlighting areas of unusually high concentrations of toxic substances as a guide to program planning and the regulatory program. Danger to public health or to marine life is not inferred unless specifically so stated.

Table 4. Results of the 1983-84 SMW Program
Dry Weight Tissue Concentrations of Trace Metals
in ug/g (ppm) and Synthetic Organic Substances in ng/g (ppb)

KEY

RCM-Resident California Mussel
TCM-Transplanted California Mussel
FWC-Freshwater Clam
OYS-Oyster
BNC-Bentnose Clam
LNC-Littleneck Clam
D-Not Detected
N-Not Analyzed

The dry weight values contained in this table can be converted to wet weight values by multiplying them by the wet weight multiplier.

TABLE 4

STATE MUSSEL WATCH TRACE METALS, 1983-1984
REPORTED AS MICROGRAMS PER GRAM, (PPM) DRY WEIGHT

REG	STATION NAME	STA NUM	SAMPLE DATE	TYPE	WET WGHT MULT	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
1	CRESCENT CITY STP	2.0	20SEP83	RCM	0.181	2.494	192.8	N	3.5	4.1	9.3	0.446	9.3	N	2.4	N	N	143.3
1	CRESCENT CITY CONT.	3.0	20SEP83	RCM	0.167	0.064	273.3	N	5.3	3.4	8.1	0.211	14.1	N	1.5	N	N	146.1
1	TRINIDAD HEAD	10.0	21SEP83	RCM	0.172	0.056	399.6	N	5.1	4.1	7.5	0.167	12.3	N	1.9	N	N	128.6
1	MAD RIVER SLOUGH	100.0	15FEB84	TCM	0.155	0.079	836.2	N	3.9	4.7	12.2	0.249	28.3	N	2.4	N	N	169.2
1	ARCATA DOCK	100.5	15FEB84	TCM	0.165	0.091	877.0	N	4.5	6.2	9.9	0.272	26.2	N	1.2	N	N	183.0
1	SAMOA BRIDGE WEST	101.0	15FEB84	TCM	0.173	0.078	1306.9	N	3.8	9.3	9.7	0.249	34.4	N	1.1	N	N	167.4
1	WOODLEY ISLAND	102.5	15FEB84	TCM	0.143	0.173	1820.4	N	5.4	13.1	10.7	0.259	39.9	N	4.4	N	N	214.9
1	EUREKA STP 1	104.0	21SEP83	TCM	0.230	0.132	367.2	N	4.1	2.7	8.1	0.081	10.9	N	0.9	N	N	107.6
1	EUREKA STP 1	104.0	15FEB84	TCM	0.136	0.122	1612.8	N	5.1	10.1	11.2	0.262	37.6	N	2.1	N	N	213.1
1	EUREKA STP CONTROL	104.5	15FEB84	TCM	0.152	0.060	1136.4	N	5.8	7.1	10.5	0.243	26.2	N	1.5	N	N	178.5
1	RUSSIAN RIVER	200.0	17JAN84	RCM	0.139	0.076	605.7	N	5.3	4.7	8.0	0.354	21.1	N	2.2	N	N	191.4
1	BODEGA HEAD	202.0	12SEP83	RCM	0.158	0.143	302.6	N	10.3	3.1	6.1	0.314	9.3	N	2.2	N	N	177.6
1	BODEGA HEAD	202.0	19APR84	RCM	0.153	0.092	240.5	N	8.7	1.5	4.8	0.297	6.3	3.0	0.9	N	24.6	120.5
2	POINT PINOLE	302.0	14DEC83	TCM	0.088	0.155	239.1	N	11.8	4.0	9.6	0.500	9.3	N	1.4	N	N	236.6
2	TREASURE ISLAND	307.0	14DEC83	TCM	0.119	0.409	812.5	N	9.1	6.5	10.7	0.471	21.6	N	3.5	N	N	256.7
2	SAN MATEO BRIDGE 8	309.0	14DEC83	TCM	0.098	0.295	194.9	N	13.0	4.1	10.1	0.313	27.4	N	2.0	N	N	285.4
2	REDWOOD CREEK MOUTH	313.0	14DEC83	TCM	0.105	0.323	332.1	N	12.2	2.7	5.9	0.511	14.2	N	1.7	N	N	240.4
2	DUMBARTON BRIDGE 14	321.0	14DEC83	TCM	0.104	0.475	577.1	N	15.7	5.2	9.4	0.675	27.5	N	3.1	N	N	332.5
3	ML YACHT HARBOR	401.3	28NOV83	RBM	0.120	0.048	645.6	N	2.7	2.5	10.8	0.495	48.9	N	1.0	N	N	159.7
3	ML YACHT HARBOR	401.3	29MAR84	RBM	0.119	0.041	751.9	N	6.1	3.4	5.8	0.345	18.2	N	1.0	N	N	150.7
3	E.S. DUCK CLUB	402.0	29MAR84	RBM	0.109	0.036	327.7	N	3.0	2.0	7.9	0.348	32.2	N	1.5	N	N	307.9
3	POINT PINOS	411.0	29FEB84	RCM	0.158	1.420	288.2	N	7.2	4.1	8.6	N	5.5	N	3.2	N	N	249.3
3	P.G. REGULAR	414.0	29FEB84	RCM	0.143	0.464	327.9	N	4.1	2.0	9.3	0.193	7.8	N	3.3	N	N	288.7
3	MONTEREY COAST GUARD	420.0	29FEB84	RCM	0.141	0.942	922.3	N	3.3	6.1	15.5	0.427	11.8	N	91.8	N	N	479.6
3	MONTEREY COAST GUARD	420.0	29FEB84	RCM	0.153	0.610	561.5	N	4.0	3.5	9.9	N	7.4	N	91.7	N	N	354.5
3	MONTEREY HAR SLAG P	421.0	29FEB84	RCM	0.137	0.245	269.8	N	1.7	3.7	21.2	N	12.0	N	1826.0	N	N	1123.3
3	MONTEREY REST WHARF	421.3	02MAR84	RCM	0.134	0.086	408.4	N	4.5	2.8	18.3	N	7.4	N	37.6	N	N	582.0
3	MONTEREY REST WHARF	421.3	02MAR84	RCM	0.123	0.150	481.4	N	7.9	3.5	25.6	N	7.0	N	86.1	N	N	634.8
3	MONTEREY COMM WHARF	421.4	02MAR84	RBM	0.158	0.077	632.6	N	3.2	2.8	11.4	N	9.3	N	5.8	N	N	226.5
3	CARMEL CONTROL	423.2	29NOV83	TCM	0.144	0.608	105.6	N	7.4	1.6	3.0	0.320	5.3	2.2	2.6	N	N	152.9
3	CARMEL STP N.	423.4	29NOV83	TCM	0.348	1.768	126.0	N	5.3	1.3	4.8	0.211	5.5	2.1	2.4	N	N	122.3
3	CARMEL STP S.	423.6	29NOV83	TCM	0.195	1.125	137.7	N	4.4	1.3	4.7	0.204	4.9	1.6	2.4	N	N	116.4
3	CAYUCOS PIER	425.5	23APR84	TCM	0.181	0.105	414.4	24.3	10.5	3.5	8.2	0.218	11.3	6.7	1.4	N	35.4	145.9
3	CAYUCOS	428.0	23APR84	RCM	0.167	0.083	194.2	N	5.9	2.7	8.3	0.362	9.6	5.0	1.6	N	22.5	215.4
3	MONTANA DE ORO	430.0	05OCT83	RCM	0.169	0.264	71.1	N	4.4	2.0	5.1	0.058	1.6	2.5	1.5	N	2.6	160.6
3	MONTANA DE ORO	430.0	01DEC83	RCM	0.119	0.323	166.2	N	6.7	3.2	6.4	0.097	3.1	3.7	2.6	N	17.9	217.8
3	MONTANA DE ORO	430.0	16FEB84	RCM	0.147	0.468	341.4	N	8.5	3.5	6.2	0.082	4.9	4.2	1.6	N	45.4	199.2
3	MONTANA DE ORO	430.0	19APR84	RCM	0.173	0.080	155.0	N	4.9	2.0	7.1	0.134	5.2	3.8	1.2	N	25.2	147.3
3	LION ROCK	431.0	05OCT83	RCM	0.160	0.199	154.6	N	4.5	1.6	6.2	0.104	3.7	1.3	0.9	N	3.8	162.7
3	LION ROCK	431.0	28FEB84	RCM	0.138	0.151	226.4	N	5.0	2.1	7.3	0.142	3.8	2.4	1.1	N	107.7	212.5
3	LION ROCK	431.0	19APR84	RCM	0.159	0.253	197.4	N	5.2	2.3	7.7	0.389	6.7	3.4	1.8	N	19.1	218.5
3	PUP ROCK	432.0	05OCT83	RCM	0.157	0.480	168.2	19.8	4.7	2.4	3.8	0.117	3.8	2.1	1.5	N	39.0	250.2
3	PUP ROCK	432.0	16FEB84	RCM	0.135	0.380	187.9	45.4	7.5	4.2	5.6	0.292	3.6	2.2	1.5	N	42.1	221.9
3	PUP ROCK	432.0	23APR84	RCM	0.153	0.196	145.4	58.4	13.3	3.3	7.6	0.629	5.2	4.0	2.9	N	17.7	297.8
3	N. DIABLO COVE	433.0	05OCT83	RCM	0.159	0.333	199.7	N	5.2	4.2	5.7	0.130	3.4	2.4	1.0	N	8.2	206.7
3	N. DIABLO COVE	433.0	16FEB84	RCM	0.133	0.354	368.6	N	8.0	5.9	6.5	0.422	4.1	3.9	2.3	N	11.6	260.7
3	N. DIABLO COVE	433.0	23APR84	RCM	0.122	0.284	693.2	N	6.4	2.7	8.4	0.157	6.3	3.9	10.9	N	16.9	265.2

TABLE 4 (Cont.)

STATE MUSSEL WATCH TRACE METALS, 1983-1984
REPORTED AS MICROGRAMS PER GRAM, (PPM) DRY WEIGHT

REG	STATION NAME	STA NUM	SAMPLE DATE	TYPE	WET WGHT MULT	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
3	S. DIABLO COVE	434.0	05OCT83	RCM	0.164	0.247	248.5	31.1	6.0	4.1	5.7	0.283	5.0	1.9	1.9	N	6.1	185.3
3	S. DIABLO COVE	434.0	16FEB84	RCM	0.137	0.505	294.5	32.6	9.8	5.6	7.9	0.439	6.0	3.6	2.1	N	14.7	250.8
3	S. DIABLO COVE	434.0	23APR84	RCM	0.139	0.417	131.4	N	8.8	3.1	7.6	0.126	5.2	3.3	1.7	N	14.7	226.6
3	INTAKE COVE	435.0	05OCT83	RCM	0.156	0.282	203.0	27.0	6.0	5.1	5.4	0.269	4.8	1.8	1.8	N	36.6	244.1
3	INTAKE COVE	435.0	16FEB84	RCM	0.136	0.526	343.5	28.1	8.2	8.0	7.4	0.372	5.6	3.6	4.9	N	12.0	312.1
3	INTAKE COVE	435.0	23APR84	RCM	0.137	0.373	161.1	N	7.4	3.5	7.1	0.067	4.4	2.8	2.5	N	12.4	258.6
3	PECHO ROCK	436.0	05OCT83	RCM	0.160	0.141	204.4	18.5	4.3	3.2	6.0	0.348	4.8	1.4	2.3	N	6.5	137.6
3	PECHO ROCK	436.0	16FEB84	RCM	0.145	0.201	265.6	46.9	6.1	3.8	6.4	0.942	5.4	3.3	2.3	N	9.7	214.2
3	PECHO ROCK	436.0	23APR84	RCM	0.148	0.500	187.8	45.4	8.4	2.5	7.4	0.735	5.9	3.5	2.1	N	79.1	235.1
3	POINT SAN LUIS	437.0	05OCT83	RCM	0.141	0.289	270.7	N	5.6	4.8	6.9	0.422	5.5	3.1	3.4	N	11.3	205.4
3	POINT SAN LUIS	437.0	23APR84	RCM	0.142	0.215	298.7	N	6.8	3.0	8.0	0.211	7.7	4.2	2.7	N	27.0	261.5
3	AVILA	438.0	16FEB84	RCM	0.158	0.272	317.2	N	5.6	2.8	8.4	0.398	5.1	4.0	4.9	N	7.2	234.6
3	AVILA	438.0	23APR84	RCM	0.150	0.786	197.0	N	9.0	2.5	9.9	0.181	7.1	4.1	3.3	N	57.9	246.9
3	LION ROCK	440.0	06DEC83	TCM	0.148	0.140	587.1	23.8	3.5	5.5	5.8	0.200	6.1	4.0	1.8	N	27.7	190.8
3	LION ROCK	440.0	28FEB84	TCM	0.132	0.339	601.6	N	8.5	8.6	8.3	0.207	8.4	5.3	4.0	N	200.2	262.5
3	LION ROCK	440.0	23APR84	TCM	0.148	0.186	369.7	N	7.2	2.8	7.6	0.217	7.0	5.0	1.6	N	32.9	201.3
3	LION/DIABLO ROCK	441.0	06DEC83	TCM	0.131	0.247	885.8	N	7.0	6.8	6.7	0.142	7.9	4.5	2.1	N	55.4	237.7
3	LION/DIABLO ROCK	441.0	28FEB84	TCM	0.136	0.200	502.5	N	6.0	6.9	6.7	0.080	7.0	5.2	1.9	N	192.0	229.5
3	LION/DIABLO ROCK	441.0	23APR84	TCM	0.158	0.126	272.5	29.1	10.0	2.5	8.3	0.246	6.9	5.1	1.6	N	29.6	216.5
3	N. DIABLO ROCK	442.0	16FEB84	TCM	0.128	0.370	521.1	N	8.3	7.2	6.9	0.241	7.1	5.1	3.2	N	145.6	264.4
3	N. DIABLO ROCK	442.0	23APR84	TCM	0.166	0.155	284.8	N	12.0	3.6	8.1	0.268	6.9	5.5	1.4	N	19.7	195.9
3	S. DIABLO COVE	443.0	06DEC83	TCM	0.118	0.255	497.3	26.2	6.6	6.5	6.5	0.092	7.4	4.9	1.9	N	30.5	272.4
3	S. DIABLO COVE	443.0	16FEB84	TCM	0.132	0.182	386.1	23.4	8.3	7.1	7.5	0.100	5.0	4.5	1.9	N	87.4	269.8
3	S. DIABLO COVE	443.0	23APR84	TCM	0.157	0.208	594.8	27.9	6.8	4.1	6.7	0.499	8.5	5.5	2.2	N	169.7	215.6
3	INTAKE COVE	444.0	28FEB84	TCM	0.122	0.242	570.7	23.8	6.2	7.3	8.7	0.149	7.4	4.2	4.1	N	96.0	273.4
3	INTAKE COVE	444.0	20APR84	TCM	0.158	0.195	301.3	20.6	9.2	3.9	8.9	0.334	7.6	3.8	2.4	N	20.6	222.1
3	SAN LUIS HBR	445.0	16FEB84	TCM	0.150	0.204	696.8	17.8	4.4	7.3	7.5	0.086	11.5	5.3	3.1	N	138.1	190.5
3	SAN LUIS HBR	445.0	23APR84	TCM	0.195	0.095	207.9	21.1	5.8	2.4	10.3	0.186	7.6	3.0	1.7	N	57.3	154.1
4	NATIONAL STEEL	601.0	29DEC83	TCM	0.149	0.067	411.6	N	11.2	6.3	18.4	0.371	37.1	N	16.1	N	N	425.1
4	WEST BASIN	602.0	29DEC83	TCM	0.131	0.064	303.4	N	9.6	6.1	27.0	0.316	30.4	N	10.1	N	N	408.8
4	BERTH 151	603.0	29DEC83	TCM	0.129	0.084	319.5	N	8.8	4.4	22.5	0.435	30.0	N	13.0	N	N	430.4
4	CABRILLO PIER	605.0	29DEC83	TCM	0.146	0.106	324.2	N	7.2	4.0	14.4	0.281	17.7	N	5.1	N	N	246.6
4	TERMINAL ISLAND	607.0	29DEC83	TCM	0.194	0.361	389.2	N	3.9	3.3	9.0	0.142	14.9	N	5.3	N	N	166.4
4	TIDE GAUGE	609.0	29DEC83	TCM	0.182	0.359	385.2	N	3.4	2.2	9.5	0.199	18.4	N	11.0	N	N	175.6
4	S. CAL. EDISON	613.0	29DEC83	TCM	0.145	0.083	406.0	N	6.1	3.3	15.0	0.259	26.2	N	9.2	N	N	304.1
4	ROYAL PALMS REGULAR	662.0	30DEC83	RCM	0.146	5.696	220.3	N	3.5	3.4	8.7	0.224	9.4	N	8.5	N	N	297.4
8	ANAHEIM NAVY HARBOR	707.0	29DEC83	TCM	0.135	0.077	251.9	N	7.6	2.1	10.9	0.266	17.2	N	14.7	N	N	229.0
8	ANAHEIM NAVY MARSH	708.0	29DEC83	TCM	0.143	0.123	326.9	N	6.9	1.8	9.8	0.219	16.3	N	6.7	N	N	236.4
8	ANAHEIM EDINGER ST	713.0	29DEC83	TCM	0.103	0.154	436.3	N	10.8	2.3	8.9	0.481	44.6	N	25.8	N	N	356.0
8	ANAHEIM WARNER AV BR	715.0	29DEC83	TCM	0.115	0.065	592.0	N	13.4	2.9	10.4	0.392	84.7	N	33.8	N	N	396.7
8	NEWPORT BAY ENTRANCE	721.0	27DEC83	TCM	0.114	0.121	644.3	N	10.2	2.4	10.1	0.349	20.8	N	11.9	N	N	272.9
8	N.B. HWY. 1 BRIDGE	724.0	27DEC83	TCM	0.109	0.091	421.1	N	12.6	2.5	7.6	0.328	20.9	N	7.3	N	N	365.6
8	CROWS NEST	725.0	27DEC83	TCM	0.122	0.171	455.2	N	8.4	1.9	38.3	0.533	35.4	N	17.8	N	N	408.0
8	N.B. UPPER RHINE CH.	726.0	27DEC83	TCM	0.118	0.099	502.8	N	11.3	2.1	61.8	0.604	50.7	N	26.6	N	N	535.5
9	OCEANSIDE	750.0	27DEC83	RCM	0.114	0.180	1578.6	N	3.1	1.9	6.5	0.123	20.0	N	1.2	N	N	246.3
9	M.B.YACHT CLUB	864.0	28DEC83	TCM	0.150	0.083	613.8	N	5.1	1.5	10.3	0.253	12.3	N	4.7	N	N	205.8
9	M.B. HILTON DOCKS	865.0	28DEC83	TCM	0.128	0.144	1004.6	N	11.0	2.3	8.9	0.373	26.2	N	7.4	N	N	224.1

TABLE 4 (Cont.)

STATE MUSSEL WATCH TRACE METALS, 1983-1984
REPORTED AS MICROGRAMS PER GRAM, (PPM) DRY WEIGHT

REG	STATION NAME	STA NUM	SAMPLE DATE	TYPE	WET WGHT MULT	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
9	FISHERMAN CHANNEL	866.0	28DEC83	TCM	0.120	0.395	1153.6	N	11.4	2.7	10.4	0.381	18.7	N	7.9	N	N	286.1
9	M.B. SEAWORLD TWR.	869.0	28DEC83	TCM	0.142	0.206	996.4	N	7.1	2.2	10.5	0.263	19.1	N	6.2	N	N	264.0
9	M. B. SO.SHO. ROC. 2	871.0	28DEC83	TCM	0.157	0.274	863.9	N	5.6	2.3	8.8	0.218	15.4	N	3.3	N	N	215.3
9	MISSION BAY	873.0	28DEC83	TCM	0.133	0.177	313.3	N	11.6	2.1	38.4	0.542	15.7	N	5.7	N	N	358.0
9	M.B. S.D. RIVER CH.	874.0	28DEC83	TCM	0.136	0.557	435.3	N	8.0	1.9	7.4	0.378	26.7	N	6.9	N	N	228.5
9	24TH ST. MAR TERM S.	882.0	04JAN84	TCM	0.151	0.435	916.7	N	9.0	2.7	78.7	0.301	34.2	N	6.4	N	N	354.3
9	PIER 13	882.4	04JAN84	TCM	0.141	0.311	613.6	N	6.4	2.7	31.8	0.278	26.2	N	6.0	N	N	332.2
9	E. BASIN SOFT.BOT	894.1	04JAN84	TCM	0.114	0.608	356.2	N	11.8	6.0	15.3	0.443	14.0	N	9.9	N	N	368.3
9	E. BASIN DOCKS	894.5	04JAN84	TCM	0.153	0.501	504.3	N	10.9	4.0	21.9	0.357	20.2	N	23.1	N	N	292.6
9	N.I.LAUNCH DOCKS	898.2	04JAN84	TCM	0.174	0.308	600.0	N	7.0	2.7	19.3	0.447	28.3	N	7.3	N	N	334.3
9	S.D.N.I PLAT	898.4	04JAN84	TCM	0.151	0.531	511.6	N	5.8	2.2	13.1	0.385	16.7	N	8.4	N	N	291.6
9	ZUNIGA JETTY	903.0	04JAN84	TCM	0.167	1.718	577.2	N	5.6	2.0	9.8	0.247	7.8	N	3.3	N	N	200.4
9	IMPERIAL BEACH PIER	904.0	04JAN84	RCM	0.145	2.085	585.9	N	1.9	1.7	8.6	0.151	11.8	N	3.4	N	N	196.0
9	TIJUANA RIVER	905.0	04JAN84	TCM	0.163	0.940	537.7	N	6.6	1.7	7.7	0.222	8.6	N	1.8	N	N	161.5

TABLE 4 (Cont.)

STATE MUSSEL WATCH ORGANICS, 1983-1984
REPORTED NANOGRAMS PER GRAM (PPB), DRY WEIGHT

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	WET WGHT MULT	ALDRIN	CHLOR BENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE
1	2.00	CRESCENT CITY STP	20SEP83	RCM	0.164	D	D	D	24.00	D	20.00
1	3.00	CRESCENT CITY CONT.	20SEP83	RCM	0.152	D	D	D	1.10	D	D
1	10.00	TRINIDAD HEAD	21SEP83	RCM	0.165	D	D	D	1.20	D	D
1	100.00	MAD RIVER SLOUGH	15FEB84	TCM	0.161	D	D	D	2.70	D	1.80
1	100.50	ARCATA DOCK	15FEB84	TCM	0.171	D	D	D	3.70	D	2.50
1	100.60	MAD RIVER OYSTER BED	14MAR84	OYS	0.166	N	N	N	N	N	N
1	101.00	SAMOA BRIDGE WEST	15FEB84	TCM	0.158	N	N	N	N	N	N
1	102.50	WOODLEY ISLAND	15FEB84	TCM	0.153	D	D	D	3.40	D	2.40
1	104.00	EUREKA STP 1	21SEP83	TCM	0.229	D	D	D	1.40	D	D
1	104.00	EUREKA STP 1	15FEB84	TCM	0.140	D	D	D	2.50	D	2.20
1	104.50	EUREKA STP CONTROL	15FEB84	TCM	0.131	D	D	D	1.40	D	D
1	200.00	RUSSIAN RIVER	17JAN84	RCM	0.111	D	D	D	10.00	D	6.60
2	302.00	POINT PINOLE	14DEC83	TCM	0.096	D	D	D	18.00	D	12.00
2	307.00	TREASURE ISLAND	14DEC83	TCM	0.124	D	D	D	9.60	D	11.00
2	309.00	SAN MATEO BRIDGE 8	14DEC83	TCM	0.092	D	D	D	18.00	D	10.00

REG	STATION NUMBER	OXY CHLORDANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLORDANE	CHLOR PYRIFOS	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS
1	2.00	2.50	D	D	46.5	D	D	D	7.40	D	71.00	D	D
1	3.00	D	D	D	1.1	D	D	D	D	D	D	D	D
1	10.00	D	D	D	1.2	D	D	D	D	D	3.20	D	D
1	100.00	D	D	D	4.5	D	D	D	D	D	2.80	D	D
1	100.50	D	D	D	6.2	D	D	D	D	D	16.00	D	D
1	100.60	N	N	N	.	N	N	N	N	N	N	N	N
1	101.00	N	N	N		N	N	N	N	N	N	N	N
1	102.50	D	N	D	5.8	D	D	D	D	D	8.40	D	D
1	104.00	D	N	D	1.4	D	D	D	D	D	4.60	D	D
1	104.00	D	N	D	4.7	D	D	D	D	D	4.40	D	D
1	104.50	D	N	D	1.4	D	D	D	D	D	3.80	D	D
1	200.00	D	N	D	16.6	D	D	D	6.50	D	24.00	D	D
2	302.00	D	N	9.50	39.5	D	D	6.50	61.00	D	64.00	D	D
2	307.00	D	N	8.30	28.9	D	D	6.60	44.00	D	51.00	D	D
2	309.00	D	N	12.00	40.0	D	D	D	17.00	D	38.00	D	D

REG	STATION NUMBER	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH
1	2.00	D	D	78.4	11.00	D	D	D	D	D	D	6.10	D
1	3.00	D	D	D	3.10	D	D	D	D	D	D	5.60	D
1	10.00	D	D	3.2	3.30	D	N	N	D	D	D	13.00	D
1	100.00	D	D	2.8	5.80	D	N	N	D	D	D	4.40	D
1	100.50	D	D	16.0	7.40	D	N	N	D	D	D	5.20	D
1	100.60	N	N	.	N	N	N	N	.	N	N	N	N
1	101.00	N	N		N	N	N	N	.	N	N	N	N
1	102.50	D	D	8.4	4.70	D	N	N	D	D	D	4.00	D
1	104.00	D	D	4.6	2.00	D	N	N	D	D	D	5.50	D
1	104.00	D	D	4.4	4.10	D	N	N	D	D	D	5.80	D
1	104.50	D	D	3.8	3.40	D	N	N	D	D	D	4.70	D
1	200.00	D	D	30.5	20.00	D	N	N	D	D	D	6.80	D
2	302.00	D	D	131.5	40.00	D	D	D	D	D	D	2.60	D
2	307.00	D	D	101.6	43.00	2.50	D	D	2.5	D	D	1.70	D
2	309.00	D	D	55.0	82.00	5.20	D	D	5.2	D	D	2.50	D

REG	STATION NUMBER	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
1	2.00	5.60	1.40	1.40	80.00	D	80	N	N	D	D	D	D
1	3.00	1.20	D	D	D	D	D	N	N	D	D	D	D
1	10.00	1.20	D	D	D	D	D	N	N	D	D	D	D
1	100.00	1.50	D	1.00	D	D	D	960.00	93.00	D	D	D	D
1	100.50	1.60	D	D	D	D	D	120.00	23.00	D	D	D	D
1	100.60	N	N	N	N	N	.	22.00	D	N	N	N	N
1	101.00	N	N	N	N	N	.	380.00	38.00	N	N	N	N
1	102.50	1.30	D	D	64.00	D	64	140.00	18.00	D	D	D	D
1	104.00	1.00	D	D	D	D	D	N	N	D	D	D	D
1	104.00	2.20	D	D	D	D	D	N	N	D	D	D	D
1	104.50	1.40	D	D	D	D	D	4.60	D	D	D	D	D
1	200.00	1.00	D	D	D	D	D	N	N	D	D	D	D
2	302.00	1.50	D	D	180.00	D	180	N	N	D	D	D	D
2	307.00	2.10	D	D	280.00	D	260	N	N	D	D	D	D
2	309.00	20.00	D	D	180.00	D	180	N	N	D	D	D	D

TABLE 4 (Cont.)

STATE MUSSEL WATCH ORGANICS, 1983-1984
REPORTED NANOGRAMS PER GRAM (PPB), DRY WEIGHT

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	WET WGHT MULT	ALDRIN	CHLOR BENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE
2	313.00	REDWOOD CREEK MOUTH	14DEC83	TCM	0.071	D	D	D	18.00	D	12.00
2	321.00	DUMBARTON BRIDGE 14	14DEC83	TCM	0.106	D	D	D	33.00	D	19.00
3	401.20	WATSONVILLE SLOUGH	28NOV83	TCM	0.166	D	17.00	3.20	63.00	4.60	44.00
3	401.30	ML YACHT HARBOR	28NOV83	RBM	0.117	D	18.00	4.10	120.00	5.40	65.00
3	401.40	KIRBY PARK	23NOV83	TCM	0.115	D	7.30	D	25.00	D	16.00
3	402.20	PARSON'S SLOUGH	23NOV83	TCM	0.140	D	5.30	D	15.00	D	5.60
3	402.30	PACIFIC MARICULTURE	07FEB84	OYS	0.080	D	D	D	9.10	D	6.20
3	402.80	E.S. SKIPPERS	02FEB84	BNC	0.113	D	D	D	4.60	D	2.60
3	402.80	E.S. SKIPPERS	02FEB84	LNC	0.109	D	D	D	3.80	D	D
3	404.00	SANDHOLT BRIDGE	28NOV83	RBM	0.137	D	D	5.40	91.00	7.80	55.00
3	405.00	ESPINOSA SLOUGH	28NOV83	FWC	0.104	D	170.00	31.00	350.00	48.00	230.00
3	405.40	OLD SALINAS R. CH.1	28NOV83	FWC	0.100	D	52.00	9.80	170.00	12.00	61.00
3	405.80	SALINAS RIVER LAGOON	28NOV83	FWC	0.093	D	68.00	13.00	140.00	13.00	88.00
3	406.00	WESTLEY STATION	09SEP83	FWC	0.129	D	28.00	5.30	82.00	5.70	56.00
3	414.00	P.G. REGULAR	29FEB84	RCM	0.154	D	D	D	7.90	D	5.50

REG	STATION NUMBER	OXY CHLORDANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLORDANE	CHLOR PYRIFOS	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS
2	313.00	D	N	12.00	42.0	D	D	D	22.00	D	44.00	D	D
2	321.00	2.80	N	15.00	69.8	D	D	D	47.00	D	48.00	D	D
3	401.20	D	N	D	114.8	D	830.00	210.00	760.00	32.00	1600.00	32.00	D
3	401.30	D	N	D	194.5	D	2200.00	210.00	620.00	34.00	1800.00	45.00	D
3	401.40	D	N	D	41.0	D	160.00	43.00	210.00	16.00	700.00	16.00	D
3	402.20	D	N	D	20.6	D	240.00	27.00	82.00	5.50	220.00	10.00	D
3	402.30	D	N	D	15.3	D	D	23.00	81.00	7.70	620.00	D	D
3	402.80	D	N	1.50	8.7	D	3.70	D	27.00	D	220.00	D	D
3	402.80	D	D	1.90	5.7	D	3.80	D	12.00	D	96.00	D	D
3	404.00	D	N	D	159.2	D	1200.00	260.00	1100.00	32.00	1700.00	16.00	D
3	405.00	D	D	D	659.0	18.00	8600.00	960.00	4300.00	110.00	9500.00	41.00	D
3	405.40	D	D	D	252.8	500.00	6700.00	510.00	2700.00	230.00	8100.00	110.00	D
3	405.80	D	D	D	254.0	260.00	4300.00	320.00	1700.00	140.00	4700.00	34.00	D
3	406.00	D	N	D	149.0	240.00	D	96.00	430.00	290.00	4700.00	33.00	D
3	414.00	D	N	D	13.4	D	D	D	5.10	D	50.00	D	D

REG	STATION NUMBER	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH
2	313.00	D	D	66.0	64.00	4.00	D	D	4.0	D	D	2.20	D
2	321.00	D	8.00	103.0	68.00	9.70	D	D	9.7	D	D	2.80	D
3	401.20	70.00	540.00	3244.0	240.00	1800.00	770.00	820.00	3390.0	44.00	D	6.60	D
3	401.30	180.00	830.00	3719.0	280.00	4700.00	3400.00	2500.00	10600.0	150.00	1.60	3.70	D
3	401.40	29.00	140.00	1154.0	160.00	650.00	340.00	840.00	1830.0	12.00	D	3.10	D
3	402.20	16.00	72.00	432.5	84.00	770.00	400.00	530.00	1700.0	15.00	D	3.30	D
3	402.30	16.00	160.00	907.7	5.80	53.00	13.00	19.00	85.0	D	D	1.70	D
3	402.80	D	25.00	272.0	6.60	40.00	43.00	55.00	138.0	D	D	1.90	D
3	402.80	D	34.00	142.0	3.60	54.00	31.00	38.00	123.0	D	D	3.90	D
3	404.00	30.00	400.00	3538.0	360.00	3500.00	1800.00	1900.00	7200.0	120.00	0.78	5.90	D
3	405.00	240.00	5900.00	21051.0	1500.00	9600.00	8500.00	6400.00	24500.0	920.00	23.00	14.00	D
3	405.40	360.00	3500.00	15510.0	450.00	4200.00	3000.00	3300.00	10500.0	320.00	7.10	6.60	D
3	405.80	210.00	1800.00	8904.0	150.00	220.00	180.00	320.00	720.0	180.00	8.20	5.00	D
3	406.00	200.00	1400.00	7149.0	14.00	260.00	270.00	150.00	680.0	D	4.00	3.70	D
3	414.00	D	10.00	65.1	18.00	41.00	N	N	41.0	D	D	3.40	D

REG	STATION NUMBER	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
2	313.00	6.20	D	D	210.00	D	210	N	N	D	D	D	D
2	321.00	3.90	D	3.30	180.00	D	180	N	N	D	D	D	D
3	401.20	6.30	D	5.70	87.00	D	87	N	N	D	D	1300.00	D
3	401.30	2.00	D	16.00	350.00	D	350	N	N	D	D	1800.00	D
3	401.40	2.80	D	9.20	79.00	D	79	N	N	D	D	400.00	D
3	402.20	1.70	D	3.20	67.00	D	67	N	N	D	D	200.00	D
3	402.30	D	D	D	160.00	D	160	N	N	D	D	370.00	D
3	402.80	6.80	D	D	83.00	D	83	N	N	D	D	200.00	D
3	402.80	2.10	D	D	64.00	D	64	N	N	D	D	250.00	D
3	404.00	4.00	D	4.20	340.00	D	340	N	N	D	D	1300.00	D
3	405.00	8.60	D	26.00	1100.00	D	1100	N	N	D	D	22000.00	D
3	405.40	9.00	D	8.70	980.00	D	980	N	N	D	D	7600.00	D
3	405.80	5.10	D	15.00	930.00	D	930	N	N	D	D	8100.00	D
3	406.00	4.30	D	D	770.00	D	770	N	N	D	D	7700.00	D
3	414.00	D	D	D	D	D	D	N	N	D	D	D	D

TABLE 4 (Cont.)

STATE MUSSEL WATCH ORGANICS, 1983-1984
REPORTED NANOGRAMS PER GRAM (PPB), DRY WEIGHT

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	WET WGHT MULT	ALDRIN	CHLOR BENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE
3	423.20	CARMEL CONTROL	29NOV83	TCM	0.146	D	D	D	4.70	D	2.60
3	423.40	CARMEL STP N.	29NOV83	TCM	0.182	D	D	D	5.20	D	3.80
3	423.60	CARMEL STP S.	29NOV83	TCM	0.160	D	D	D	6.60	D	4.50
3	430.00	MONTANA DE ORO	05OCT83	RCM	0.151	N	N	N	N	N	N
3	430.00	MONTANA DE ORO	16FEB84	RCM	0.140	N	N	N	N	N	N
3	434.00	S. DIABLO COVE	05OCT83	RCM	0.130	N	N	N	N	N	N
3	434.00	S. DIABLO COVE	16FEB84	RCM	0.130	N	N	N	N	N	N
3	435.00	INTAKE COVE	05OCT83	RCM	0.159	N	N	N	N	N	N
3	435.00	INTAKE COVE	16FEB84	RCM	0.136	N	N	N	N	N	N
3	436.00	PECHO ROCK	05OCT83	RCM	0.171	N	N	N	N	N	N
3	436.00	PECHO ROCK	16FEB84	RCM	0.126	N	N	N	N	N	N
3	437.00	POINT SAN LUIS	05OCT83	RCM	0.154	N	N	N	N	N	N
3	441.00	LION/DIABLO ROCK	06DEC83	TCM	0.141	N	N	N	N	N	N
3	441.00	LION/DIABLO ROCK	23APR84	TCM	0.151	N	N	N	N	N	N
3	443.00	S. DIABLO COVE	06DEC83	TCM	0.141	N	N	N	N	N	N

REG	STATION NUMBER	OXY CHLORDANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLORDANE	CHLOR PYRIFOS	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS
3	423.20	D	N	D	7.3	D	D	D	D	D	26.00	D	D
3	423.40	D	N	D	9.0	D	D	D	5.00	D	24.00	D	D
3	423.60	D	N	D	11.1	D	D	D	4.30	D	32.00	D	D
3	430.00	N	N	N	.	N	N	N	N	N	N	N	N
3	430.00	N	N	N	.	N	N	N	N	N	N	N	N
3	434.00	N	N	N	.	N	N	N	N	N	N	N	N
3	434.00	N	N	N	.	N	N	N	N	N	N	N	N
3	435.00	N	N	N	.	N	N	N	N	N	N	N	N
3	435.00	N	N	N	.	N	N	N	N	N	N	N	N
3	436.00	N	N	N	.	N	N	N	N	N	N	N	N
3	436.00	N	N	N	.	N	N	N	N	N	N	N	N
3	437.00	N	N	N	.	N	N	N	N	N	N	N	N
3	441.00	N	N	N	.	N	N	N	N	N	N	N	N
3	441.00	N	N	N	.	N	N	N	N	N	N	N	N
3	443.00	N	N	N	.	N	N	N	N	N	N	N	N

REG	STATION NUMBER	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH
3	423.20	D	D	26.0	6.20	6.80	D	D	6.8	D	D	5.80	D	0.53
3	423.40	D	4.60	33.6	4.80	6.10	D	D	6.1	D	D	6.60	D	0.59
3	423.60	D	6.10	42.4	6.20	7.20	D	D	7.2	D	D	8.10	D	0.77
3	430.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	430.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	434.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	434.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	435.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	435.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	436.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	436.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	437.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	441.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	441.00	N	N	.	N	N	N	N	.	N	N	N	N	N
3	443.00	N	N	.	N	N	N	N	.	N	N	N	N	N

REG	STATION NUMBER	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
3	423.20	D	D	28.00	D	28	N	N	D	D	D	D
3	423.40	D	D	29.00	D	29	N	N	D	D	D	D
3	423.60	D	D	39.00	D	39	N	N	D	D	D	D
3	430.00	N	N	D	D	D	N	N	N	N	N	N
3	430.00	N	N	22.00	D	22	N	N	N	N	N	N
3	434.00	N	N	28.00	D	28	N	N	N	N	N	N
3	434.00	N	N	40.00	D	40	N	N	N	N	N	N
3	435.00	N	N	19.00	D	19	N	N	N	N	N	N
3	435.00	N	N	24.00	D	24	N	N	N	N	N	N
3	436.00	N	N	40.00	D	40	N	N	N	N	N	N
3	436.00	N	N	38.00	D	38	N	N	N	N	N	N
3	437.00	N	N	36.00	D	36	N	N	N	N	N	N
3	441.00	N	N	18.00	D	18	N	N	N	N	N	N
3	441.00	N	N	33.00	D	33	N	N	N	N	N	N
3	443.00	N	N	25.00	D	25	N	N	N	N	N	N

...RDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
[illegible]	42.00	D	34.00
.00	45.00	D	32.00
.10	81.00	D	62.00

DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
.00	44.00	900.00	D	48.00
.00	46.00	610.00	D	38.00
.00	66.00	670.00	10.00	26.00
.00	79.00	910.00	11.00	24.00
.00	45.00	730.00	D	26.00
.00	26.00	880.00	D	D
.00	44.00	710.00	7.80	14.00
.00	12.00	580.00	D	D
.00	13.00	500.00	D	24.00
.00	6.80	730.00	D	D

ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
D	D	1.90	D	4.90
D	D	3.00	D	9.10
D	D	2.00	D	11.00

PARA THION	RONNEL	TOXA PHENE	TEDION
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
N	N	N	N
D	D	D	D
D	D	D	D
D	D	270.00	D

Table 4 (Cont.)

STATE MUSSEL WATCH ORGANICS, 1983-1984
REPORTED NANOGRAMS PER GRAM (PPB), DRY WEIGHT

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	WET WGHT MULT	ALDRIN	CHLOR BENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE
8	715.00	ANAHEIM WARNER AV BR	29DEC83	TCM	0.070	D	40.00	6.90	150.00	D	100.00
8	721.00	NEWPORT BAY ENTRANCE	27DEC83	TCM	0.111	N	N	D	64.00	D	46.00
8	723.00	BAY ISLAND	04JAN84	TCM	0.137	N	N	12.00	230.00	D	150.00
8	724.00	N.B. HWY. 1 BRIDGE	27DEC83	TCM	0.099	D	D	6.20	210.00	D	110.00
8	725.00	CROWS NEST	27DEC83	TCM	0.106	D	D	9.30	170.00	D	89.00
8	726.00	N.B. UPPER RHINE CH.	27DEC83	TCM	0.116	N	N	6.10	160.00	D	83.00
9	750.00	OCEANSIDE	27DEC83	RCM	0.120	D	D	D	11.00	D	8.00
9	865.00	M.B. HILTON DOCKS	28DEC83	TCM	0.132	33.00	28.00	D	92.00	D	50.00
9	869.00	M.B. SEAWORLD TWR.	28DEC83	TCM	0.133	3.70	D	D	20.00	D	14.00
9	870.00	M. B. SO.SHO. ROC. 1	28DEC83	TCM	0.134	4.20	6.40	D	22.00	D	12.00
9	872.00	M. B. SO.SHO. ROC. 3	28DEC83	TCM	0.161	2.80	14.00	D	34.00	D	22.00
9	874.00	M.B. S.D. RIVER CH.	28DEC83	TCM	0.140	D	26.00	D	90.00	D	57.00
9	894.10	E. BASIN SOFT.BOT	04JAN84	TCM	0.106	N	N	N	N	N	N
9	894.50	E. BASIN DOCKS	04JAN84	TCM	0.136	N	N	N	N	N	N
9	898.20	N.I.LAUNCH DOCKS	04JAN84	TCM	0.159	N	N	N	N	N	N

REG	STATION NUMBER	OXY CHLORDANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLORDANE	CHLOR PYRIFOS	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS
8	715.00	5.90	N	D	262.8	10.00	5.00	46.00	340.00	4.60	1200.00	D	D
8	721.00	2.60	N	11.00	123.6	N	N	27.00	310.00	8.40	890.00	D	D
8	723.00	8.70	N	78.00	473.7	N	N	120.00	940.00	48.00	2900.00	6.70	D
8	724.00	6.30	D	16.00	348.5	D	N	90.00	790.00	16.00	2600.00	D	D
8	725.00	8.70	D	45.00	322.0	D	N	76.00	570.00	30.00	1100.00	67.00	D
8	726.00	9.40	N	31.00	289.5	N	N	62.00	400.00	20.00	1000.00	D	D
9	750.00	D	N	D	19.0	D	D	11.00	32.00	3.90	280.00	D	D
9	865.00	8.00	N	D	150.0	4.30	D	16.00	16.00	D	43.00	D	D
9	869.00	D	N	D	34.0	D	D	24.00	11.00	D	75.00	D	D
9	870.00	3.10	N	D	37.1	2.30	D	50.00	9.40	D	66.00	D	D
9	872.00	1.60	N	D	57.6	9.00	D	95.00	15.00	D	50.00	D	D
9	874.00	3.30	D	D	150.3	D	D	14.00	30.00	D	97.00	D	D
9	894.10	N	N	N	.	N	N	N	N	N	N	N	N
9	894.50	N	N	N	.	N	N	N	N	N	N	N	N
9	898.20	N	N	N	.	N	N	N	N	N	N	N	N

REG	STATION NUMBER	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH
8	715.00	5.20	100.00	1695.8	59.00	3.80	N	N	3.8	D	D	1.50	D	9.90
8	721.00	4.80	130.00	1370.2	N	N	N	N	.	N	N	N	N	N
8	723.00	23.00	340.00	4377.7	N	N	N	N	.	N	N	N	N	N
8	724.00	6.80	330.00	3832.8	N	N	N	N	.	N	D	1.80	D	4.00
8	725.00	D	68.00	1911.0	N	N	N	N	.	N	D	2.40	D	2.80
8	726.00	9.60	86.00	1577.6	N	N	N	N	.	N	N	N	N	N
9	750.00	4.10	94.00	425.0	D	21.00	N	N	21.0	D	D	1.80	D	D
9	865.00	D	6.00	81.0	85.00	D	N	N	D	D	D	2.70	D	3.90
9	869.00	D	D	110.0	18.00	D	N	N	D	D	D	2.00	D	1.20
9	870.00	D	D	125.4	17.00	D	N	N	D	D	D	1.50	D	0.95
9	872.00	D	D	160.0	21.00	D	N	N	D	D	D	2.40	D	2.00
9	874.00	D	10.00	151.0	31.00	D	N	N	D	D	D	2.80	D	3.60
9	894.10	N	N	.	N	N	N	N	.	N	N	N	N	N
9	894.50	N	N	.	N	N	N	N	.	N	N	N	N	N
9	898.20	N	N	.	N	N	N	N	.	N	N	N	N	N

REG	STATION NUMBER	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
8	715.00	D	4.60	710.00	D	710	N	N	D	D	220.00	D
8	721.00	N	N	260.00	D	260	N	N	N	N	N	N
8	723.00	N	N	710.00	D	710	N	N	N	N	N	N
8	724.00	D	3.00	450.00	D	450	N	N	N	D	880.00	N
8	725.00	D	3.90	2600.00	460.00	3060	N	N	N	D	480.00	N
8	726.00	N	N	2700.00	280.00	2980	N	N	N	N	N	N
9	750.00	D	D	52.00	D	52	N	N	D	D	270.00	D
9	865.00	D	4.20	140.00	D	140	N	N	D	D	D	D
9	869.00	D	D	260.00	D	260	N	N	D	D	D	D
9	870.00	D	D	270.00	D	270	N	N	D	D	D	D
9	872.00	D	2.00	380.00	D	380	N	N	D	D	D	D
9	874.00	D	2.20	360.00	D	360	N	N	D	D	D	D
9	894.10	N	N	12000.00	7000.00	19000	N	N	N	N	N	N
9	894.50	N	N	4300.00	1000.00	5300	N	N	N	N	N	N
9	893.20	N	N	820.00	66.00	886	N	N	N	N	N	N

3.1 ELEVATED TOXIC POLLUTANT LEVELS

In order to compare the results of the current (most recent) monitoring year with those of all monitoring years, the concept of an Elevated Toxic Pollutant Level (ETPL) was developed. ETPLs are determined independently for resident and transplanted California mussels (*Mytilus californianus*) and for selected toxic substances as follows: (1) All data from 1977-1984 were pooled. The concentrations of each toxicant with a sufficiently large data base were then ranked in ascending order; (2) the actual frequency of occurrence for each concentration and the cumulative frequency for all concentrations were determined, and (3) the concentrations of the toxic substance representing the 75th and 90th cumulative frequency percentile were identified. These concentrations have been designated as the 75% ETPL (ETPL 75) and the 90% ETPL (ETPL 90). The 75% ETPL is that concentration of a toxic substance in resident or transplanted mussels that equals or exceeds 75% of all measurements of the toxic substance in the same mussel type between 1977 and 1984 (upper quartile value). Likewise, the 90% ETPL is that concentration of a toxic substance in resident or transplanted mussels that equals or exceeds 90% of all measurements of the toxic substance in the same type of mussel (upper decile value). The ETPLs for trace metals, based on 1977-84 data, are summarized in Table 5. The ETPLs for synthetic organic substances, based on 1979-84 data, are summarized in Table 6. Plots of selected ETPLs are included in Appendix E.

This internal ranking concept was developed to indicate, for the toxic substances measured during the most recent monitoring year, those locations where levels are significantly higher than the levels measured statewide. Because the ETPLs are based on a percentage of the total measurements obtained rather than a percentage of the highest concentration obtained, they are not influenced by unusually high (anomalous) toxicant values.

This robustness is especially desirable in the evaluation of synthetic organic toxicants where the highest concentration of record by SMW may be more than ten times the next highest concentration. ETPLs do, however, reflect the biases of the data upon which they have been based. For instance, ETPLs for transplanted mussels are usually higher than ETPLs for resident mussels because transplanted mussels have been used most frequently as the indicator organisms in site specific surveys at previously determined problem areas. Hence, the apparent difference between ETPLs for resident and transplanted mussels is probably the result of the study design.

The use of ETPLS in this report is solely for the purpose of comparing spatial trends of toxicant levels by relating the most recently collected monitoring results with the previously measured levels. The ETPLs do not necessarily represent concentrations that may be damaging to the mussel or which otherwise render the mussel unfit for human consumption. ETPLs do not assess adverse impacts.

In the rest of this report, the levels of toxic substances in transplanted and resident mussels from 1983-84 were compared to the respective ETPLs shown in Table 5 and Table 6.

Table 5. Elevated Toxic Pollutant Levels (ETPLs) for Trace Metals in California Mussels

	Resident California Mussels		Transplanted California Mussels	
Pollutant	75% ETPL[1/]	90% ETPL[2/]	75% ETPL[1/]	90% ETPL[2/]
Aluminum (Al)[3/]	316	530	593	803
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 6 Elevated Toxic Pollutant Levels (ETPLs) for Synthetic Organic Substances in California Mussels

POLLUTANT	RESIDENT CALIFORNIA MUSSELS		TRANSPLANTED CALIFORNIA MUSSELS	
	75% ETPL 1/	90% ETPL 2/	75% ETPL 1/	90% ETPL 2/
Aldrin	0.5 3/	0.5	0.5	0.5
Chlorbenside	2.5	4.9	9.0	17.4
Cis-chlordane	13.0	19.0	39.8	110.0
Trans-Chlordane	8.8	17.0	29.0	78.0
Alpha-Chlordene	1.0	1.0	1.2	6.3
Gamma-Chlordene	1.0	1.0	1.0	2.3
Cis-nonachlor	1.0	1.0	1.0	2.4
Trans-nonachlor	5.2	12.0	18.0	62.0
Oxychlordane	1.1	2.4	3.2	5.4
Total chlordane	30.8	48.0	85.8	270.0
Heptachlor	0.5	0.5	0.5	1.1
Heptachlor epoxide	0.9	0.9	0.9	3.3
Chlorpyrifos	2.1	2.1	2.1	2.1
Dacthal	1.7	2.7	2.4	10.6
o,p'DDD	8.0	20.2	52.0	95.0
p,p'DDD	15.2	50.7	187.5	619.0
o,p'DDE	86.2	127.0	58.5	88.9
p,p'DDE	55.0	296.0	720.0	1,100.0
p,p'DDMU	47.0	75.6	50.2	69.4
p,p'DDMS	27.5	33.0	43.0	61.9
o,p'DDT	4.0	9.1	24.5	47.2
p,p'DDT	13.0	21.2	85.0	176.0
Total DDT	78.9	413.9	1,158.0	1,930.6
Dieldrin	10.0	18.0	35.0	62.6
Endosulfan I	2.3	9.5	3.0	24.6
Total endosulfan	5.5	14.0	3.0	24.6
Hexachlorobenzene	0.5	1.0	1.0	1.5
Alpha-HCH	8.9	12.0	5.2	7.3
Beta-HCH	1.0	8.2	1.0	2.0
Gamma-HCH	1.2	2.3	3.6	5.7
PCB 1248	10.0	10.0	10.0	10.0
PCB 1254	66.0	202.0	960.0	2,120.0
Total PCB	66.0	202.0	970.0	2,232.0
Pentachlorophenol	-	-	320.0	960.0
Ronnel	1.0	1.0	1.0	1.0
Toxaphene	60.0	60.0	60.0	260.0

1. The concentration at or below which 75% of all measurements lie.
2. The concentration at or below which 90% of all measurements lie.
3. ETPLS for synthetic organic substances are expressed as ng/g dry weight.

3.2 COASTAL REFERENCE STATIONS

An objective of the SMW is to follow temporal trends in toxic substances levels along California's coast. To accomplish this, a limited number of reference stations have been systematically monitored by the SMW each year since implementation of the program in 1977. Reference stations were selected to provide an indication of toxic pollutant levels in resident California mussels from sites in several coastal zones, e.g., northern and central coastal zones, Los Angeles Basin, and the vicinity of San Diego. Reference stations are shown in Figure 1.

3.2.1 ELEVATED TOXIC POLLUTANT LEVELS AT COASTAL REFERENCE STATIONS

Although coastal reference stations were purposely located away from sources of marine and estuarine pollution, measurements of trace metals at these stations met or exceeded 75% ETPLs on sixteen occasions. These measurements also exceeded 90% ETPLs on five occasions. The elevated trace metal levels at these stations indicate, for the most part, elevated baseline levels due to natural conditions rather than to specific (point) sources of pollution. However, the southern California reference stations (Royal Palms and Oceanside) near the heavily industrialized and urbanized Los Angeles and San Diego areas generally have elevated baseline levels of trace metals due to large volumes of industrial processing discharges, municipal discharges, runoff from urban and manufacturing sites, and aerosol input of pollutants including leaded automobile and boat fuels.

Resident Bay mussels from the Royal Palms Station (662.0) northwest of Los Angeles showed 5.70 mg/g of silver which far exceeds the 75% ETPL of 2.00 ug/g for silver. Elevated silver concentrations appear to be closely related to municipal wastewater discharges. However, the 1983-84 silver level is less than the 1982-83 level of 8.87 mg/g, and indicates that the silver level, although elevated, is evidently not increasing in the general area.

Resident Bay mussels from the Royal Palms station also had 8.54 ug/g of lead present in their tissues which exceeds the 75% ETPL of 5.9 ug/g for lead. The 1983-84 measurement is about the same as the 1982-83 measurement of 7.88 ug/g, but considerably less than the higher levels measured at this station in the early SMW monitoring years of 1977-80.

The 90% ETPL of 252.7 ug/g for zinc in resident mussels was exceeded at the Pacific Grove (288.73 ug/g) and Royal Palms (297.40 ug/g) reference stations, and the 75% ETPL of 206.7 ug/g was exceeded at the Oceanside (246.3 ug/g) reference station. Zinc levels at coastal reference stations in Southern California have been historically high; this trend continues. Metallic zinc and zinc salts are used extensively in galvanizing, alloy preparation, photoengraving, and pigment/dye preparation. These and other processes could be contributing to the elevated baseline levels of zinc in southern California. The slag site in Monterey Harbor appears to be rich in copper and zinc as well as lead. Leachate from this area may have contributed to the elevated level of zinc at the Pacific Grove reference station.

The 75% ETPL of 7.6 ug/g for copper in resident California mussels was essentially equalled at the Trinidad Head reference station where a value of 7.55 ug/g was obtained. The 75% ETPL was exceeded at the Pacific Grove (9.29 ug/g) and Royal Palms (8.75 ug/g) reference stations. Copper is widely present in the geological formations of northern California. Erosion and drainage from these formations and from mining activities could have contributed to elevated copper levels along the coast. Copper leachate from the Monterey Harbor slag pile could have contributed to the elevated levels of copper at the Pacific Grove reference station. Finally, metallic copper and copper salts are used in alloy making, electrical circuitry, textile processing, electroplating and pigment/dye preparation. These and other industrial processes in the

Aluminum and aluminum salts are used in dying and refining operations, leather tanning and finishing, disinfection, and water treatment (McKee and Wolfe, 1963). Any of these and other sources of aluminum could account for the remarkably high levels of aluminum at the Oceanside station. Monitoring for aluminum will be continued at all coastal reference stations.

The 75% ETPL of 9.5 ug/g for manganese in resident California mussels was exceeded at the Trinidad Head Station where 12.3 ug/g of manganese was measured. As with aluminum, an exceptionally high level of manganese was measured at the Oceanside coastal reference station. The 20.0 ug/g measured there exceeded the 90% ETPL for manganese of 13.2 ug/g by a considerable margin. Manganese ores are common and widely distributed. The rural Trinidad Head Station may receive manganese input though natural processes such as runoff from coastal drainages.

Manganese or its salts are used extensively in steel alloys, battery manufacture, glass and ceramics, paint and varnish manufacture, in inks and dyes, and in agriculture as a soil enricher (McKee and Wolf, 1963). Wastes from any of these or other manganese sources could be entering the waters and sediment of the Oceanside area. Like aluminum, insoluble salts of manganese can settle into the sediment and subsequently be ingested by resident mussels. The manganese measured by SMW may be in the digestive tract as sediment, rather than incorporated into body tissues. Since manganese levels in resident mussels from Oceanside were elevated in previous years (17.52 ug/g in 1982-83 and 11.0 ug/g in 1981-82), monitoring for manganese should continue at this reference station in the future.

Extremely high levels of cadmium were found in resident mussels at the Bodega Head coastal reference station. In fact, the 10.3 ug/g measured there exceeds the 90% ETPL of 9.7 ug/g for cadmium, and exceeds the 8.04 ug/g measured at Bodega Head in 1982-83. However, since 11.0 ug/g of cadmium was measured there by SMW in 1981-82, there appears to be a long-standing elevation of cadmium baseline levels in the area. Cadmium occurs in nature largely as a sulfide salt, frequently in association with zinc and lead ores. Accumulations of cadmium in soils in the vicinity of mines and smelters may result in high local concentrations in nearby waters. The salts of the metal may also occur in wastes from electroplating plants, pigment smelters, and textile and chemical plants (EPA, 1976).

In general, the levels of synthetic organic substances in resident California mussels at the coastal reference stations were low, and exceeded the ETPL 75 and ETPL 90 for synthetic organic substances on few occasions. In northern California, alpha hexachlorocyclohexane (alpha-HCH) and gamma hexachlorocyclohexane (gamma-HCH) levels in resident California mussels exceeded the alpha-HCH ETPL 90 and gamma-HCH ETPL 75 respectively at the Trinidad Head coastal reference station. Mussels at the Bodega Head coastal reference station showed dieldrin levels that exceeded the ETPL 90. In central California, mussels at the Pacific Grove reference station also had dieldrin levels that exceeded the dieldrin ETPL 90. In addition, endosulfan I levels in mussels exceeded the endosulfan I ETPL 90 at the Pacific Grove reference station. In Southern California, total DDT levels exceeded the total DDT ETPL 90 at the Royal Palms and Oceanside coastal reference stations. Finally, toxaphene levels at the Oceanside reference station exceeded the toxaphene ETPL 90.

The source or sources of alpha-HCH and gamma-HCH in the Trinidad Head area is presently not known. HCH is a broad spectrum insecticide. The gamma-isomer (lindane) has been shown to be the insecticidally active ingredient in technical grade HCH, and the purified isomer has gained significant commercial use. The use of HCH to prevent insect damage to wood in logging and wood treatment operations in the Trinidad Head area could amount for the exceptionally high alpha-HCH and gamma-HCH levels at this rural coastal reference station. It is interesting to note that alpha-HCH levels were elevated in California mussels transplanted in Humboldt Bay. Section 3.3.2.4 of this report discusses these results in detail. Extensive logging, wood processing, and wood storage operations occur in the Humboldt Bay area.

The elevated levels of dieldrin at the Bodega Head and Pacific Grove reference stations could be related to the current and past use of aldrin in residential and structural pest control in the surrounding areas. The characteristics and usage of aldrin and dieldrin are discussed in some detail in Section 3.3.4 of this report, and will only be briefly discussed here. Aldrin is metabolically converted in the environment to the more stable and persistent dieldrin. The primary pest control usage of aldrin is sub-surface soil injection for termite control. Runoff from treated areas could then be causing the elevated dieldrin levels at these relatively rural reference stations.

The elevated endosulfan I levels at the Pacific Grove reference station could be related to its past and present use as an insecticide. Section 3.3.5.2 of this report describes the characteristics and usage of this broad spectrum insecticide in detail. Endosulfan is used on a wide variety of agricultural crops in nearby agricultural areas such as the Salinas Valley. It is possible that runoff from the Monterey Peninsula area could be contributing to the elevated endosulfan I levels at the Pacific Grove reference station.

The 867.6 ng/g (131.9 ng/g wet weight) of total DDT measured at the Royal Palms coastal reference station and the 425.0 ng/g (51.0 ng/g wet weight) measured at the Oceanside coastal reference station both exceeded the total DDT ETPL 90 of 413.9 ng/g. These elevated DDT levels are most probably due to past usage of DDT. Although DDT has been banned since 1972, DDT and its metabolic degradation products continue to be present at elevated levels in areas receiving runoff from urban and agricultural areas because of the persistence of DDT, and its ability to be dispersed widely within the terrestrial and aquatic environments.

The elevated levels of toxaphene at the Oceanside reference station could be due to past usage of toxaphene in the Oceanside area. The usage of toxaphene is presently restricted, but it was used widely prior to 1982 as an insectiude on a wide variety of crops. The characteristics and usage of toxaphene are described in more detail in Section 3.3.5.1 of this report.

3.2.2 STATEWIDE PATTERNS AT COASTAL REFERENCE STATIONS

An examination of the results collected at the reference stations between 1978 and 1984 reveals that the trace metals displayed temporal trends. These 1983-84 findings are displayed in Table 7.

Table 7 Trace Metals at the Coastal Reference Stations

Station Number	Station Name	Trace Metals (ug/g dry weight) Ag	Al	Cd	Cr	Cu	Mn	Pb	Zn	Hg
10	Trinidad Head	0.06	400	5.1	4.1	7.5	12.3	1.9	129	0.17
202	Bodega Head	0.14	303	10.3	3.1	6.1	9.3	2.2	178	0.31
414	Pacific Grove	0.46	328	4.1	2.0	9.3	7.8	3.3	289	0.19
662	Royal Palms	5.70	220	3.5	3.4	8.7	9.4	8.5	297	0.22
750	Oceanside	0.18	1579	3.1	1.9	6.5	20.0	1.2	246	0.12

The 1983-84 trace metal findings are discussed in the following subsections. The usage and characteristics of the metals and their salts are discussed in Section 3.2.1 of this report.

3.2.2.1 SILVER

Silver at coastal reference stations continued to show the pattern found in previous years. Mussels from northern and central California and Oceanside continue to contain very low levels of silver in comparison to the urban Los Angeles area. Elevated silver concentrations appear to be closely related to municipal wastewater discharges. Outfall monitoring at Cresent City indicates that this relationship exists even with the smaller municipal wastewater discharges. While the prime sources of the silver have not been determined conclusively, municipal discharges are suspected to be the source of the elevated levels of silver at the Royal Palms station near Los Angeles. This station is a mainland site in the proximity of the Whites Point Outfall.

The magnitude of the differences in silver values between reference stations is often significant. Over the seven year period of record, the range of silver values between the lowest silver concentration measured (0.027 ug/g at Trinidad Head during the 1976-77 monitoring year) and the highest concentration measured (58.750 ug/g at Point Loma during the 1980-81 monitoring year) exceeded a 2,000-fold difference. The 1983-84 SMW monitoring effort produced almost a 100-fold difference in silver values between the rural area Trinidad Head reference station with 0.06 ug/g of silver in mussels and the urban area Royal Palms reference station with 5.70 ug/g silver in mussels.

The rural Trinidad Head and Bodega Head stations continued to have low silver levels as did the Pacific Grove station. The 5.70 ug/g of silver in mussels at Royal Palms, although elevated, is less than the 8.87 ug/g measured in 1982-83, and close to the lowest levels measured in 1979-80 and and 1981-82. The 0.18 ug/g of silver measured at the Oceanside station in 1983-84, although only slightly lower than silver measurements of the previous two years, is the lowest ever measured at this coastal reference station.

3.2.2.2 Lead

Lead at Coastal Reference Stations also continued to show the pattern found in previous years. Mussels from Trinidad Head and Bodega Head in northern California and Oceanside in southern California continue to have low levels of lead. Elevated levels of lead continue to be found at Pacific Grove in central California and at Royal Palms near Los Angeles. Lead can reach the aquatic or marine environment through both industrial and municipal wastewater discharges as well as through non-point sources such as precipitation, fallout of lead dust, and sheet runoff (EPA, 1976). Lead is apparently entering the marine environment through one or more of these mechanisms at all reference stations, but most excessively at the Royal Palms reference station. Elevated levels of lead at the Pacific Grove reference station appear to be from a specific source of lead. Within Monterey Harbor, a pile of lead ore and slag waste has been identified along a stretch of the old Southern Pacific Railroad tracks and appears to be a significant source of lead input to the waters of the Monterey area. The results of SMW monitoring for lead in Monterey Harbor are discussed in detail in Section 3.3.6 of this report.

Year-to-year differences in the levels of lead at each reference station continued to show trends over time at specific sites. The rural Trinidad Head and Bodega Head stations continued to have low lead levels, although elevated over 1982-83 SMW levels. The historically high levels of lead at the relatively rural Pacific Grove reference station continued but at a reduced level of approximately half of the 1981-82 and 1982-83 levels. The lead level at Royal Palms in 1983-84 was slightly greater than the 1981-82 and 1982-83 levels, but still considerably less than levels previously measured. Lead levels at Oceanside in 1983-84 were the lowest measured at any coastal reference station and were equal to low levels of lead measured during 1982-83.

3.2.2.3 MERCURY

Mercury levels in 1983-84 were slightly lower than 1982-83 levels at all coastal reference stations except Bodega Head. There, the 0.31 ug/g measured was greater than the 0.23 ug/g measured in 1982-83. As in previous years, the relatively rural Trinidad Head and Oceanside coastal reference stations had the lowest levels of mercury.

3.2.2.4 COPPER

Copper at coastal reference stations was found at levels similar to those of previous years, with a range from 6.1 ug/g at Bodega Head to 9.3 ug/g at Pacific Grove. Leachate from the copper-rich slag site in Monterey Harbor could be contributing to the elevated copper levels at the Pacific Grove station.

3.2.2.5 ZINC

Zinc at coastal reference stations was found at levels similar to those of previous years with the exception of the Oceanside station. There, the 246 ug/g measured in 1983-84 exceeded the 175 ug/g measured in 1982-83 and the 100 ug/g measured in 1981-82 by a considerable margin. Monitoring for zinc at this coastal reference station should continue. As in all previous years, the baseline levels of zinc in the Trinidad Head and Bodega Head stations of northern California were less than the levels at the Pacific Grove and Royal Palms stations of central and southern California respectively. As mentioned prevously, the slag site in Monterey Harbor appears to be rich in copper and zinc as well as lead. Leachate from this area may have contributed to the elevated zinc levels at the Pacific Grove reference station.

3.2.2.6 CADMIUM

Baseline levels of cadmium in northern and central California appear to be higher than those of southern California. The 10.3 ug/g of cadmium measured at the Bodega Head reference station is three times greater than the levels of 3.5 ug/g and 3.1 ug/g measured at the Royal Palms and Oceanside coastal reference stations respectively. The 5.1 ug/g of cadmium at Trinidad Head and 4.1 ug/g of cadmium at Pacific Grove also exceeded the levels at the southern California reference stations. There appears to be a long standing elevation of baseline cadmium levels in northern and central California. The previous two SMW monitoring years produced cadmium levels similar to or greater than those found at Trinidad Head, Bodega Head, and Pacific Grove in 1983-84.

3.2.2.7 CHROMIUM

Baseline levels of chromium followed a pattern somewhat similar to cadmium, with levels in northern California higher than those of the remaining coastal reference stations except Royal Palms. The 4.1 ug/g of chromium measured at the Trinidad Head station is twice the chromium levels of 2.0 ug/g and 1.9 ug/g measured at the Pacific Grove and Oceanside coastal reference stations respectively. In addition, the 1983-84 chromium levels at all coastal reference stations except Royal Palms were greater than they were in 1981-82 and 1982-83. Monitoring of chromium should continue at the coastal reference stations to determine future trends.

3.2.2.8 ALUMINUM AND MANGANESE

Aluminum and manganese levels at the coastal reference stations showed strikingly similar patterns. Table 7 shows that the Oceanside reference station has much higher levels of aluminum and manganese than the remaining reference stations. In both cases, the Trinidad Head reference station had the next highest levels of these trace metals. The aluminum level at Oceanside, at 1579 ug/g, is almost four times the 400 ug/g at Trinidad Head. The discrepancy between these two stations is less dramatic with manganese. However, the 20.0 ug/g of manganese at Oceanside exceeds the 12.3 ug/g of manganese measured at Trinidad Head by a considerable margin. The similarity of the measurements of aluminum and manganese suggests a common pattern of entry and metabolism of these two trace metals within mussels. As described previously in Section 3.2.1 of this report, insoluble salts of aluminum and manganese settle into the sediment and can then be ingested by resident mussels. Aluminum measured by SMW may be in the digestive tract as sediment rather than incorporated into body tissues.

The 1983-84 aluminum and manganese levels at all coastal reference stations except Oceanside were close to the levels measured in 1981-82 and 1982-83. The levels of aluminum and manganese at the Oceanside reference station showed a disturbing trend of increasing levels over time. Aluminum has increased from 630 ug/g in 1981-82 to 777 ug/g in 1982-83 to 1579 ug/g in 1983-84. Manganese has increased from 11.0 ug/g in 1981-82 to 17.5 ug/g in 1982-83 to 20.0 ug/g in 1983-84.

3.3 SITE SPECIFIC SURVEYS

3.3.1 CRESCENT CITY SEWAGE TREATMENT PLANT OUTFALL SURVEY

SMW monitoring has been conducted in the Crescent City area since the 1982-83 monitoring year. The locations of the sampling stations are shown on Figure 3. At the request of the North Coast Regional Board, SMW established a sampling station in 1982-83 at the Crescent City wastewater outfall at Battery Point (2.0) and a reference site at Preston Rock (3.0), approximately 1.5 km north. Samples were collected and analyzed for trace metals and synthetic organic compounds. The levels of silver measured in mussels collected near the outfall were 15 times greater than the levels in mussels from the reference station. In addition, mercury levels at the outfall were three times greater than the levels at the reference station. At the request of the Regional Board, the City investigated potential silver and mercury discharges to the wastewater system. Some sources of silver discharge were identified and controlled, but no sources of mercury were found.

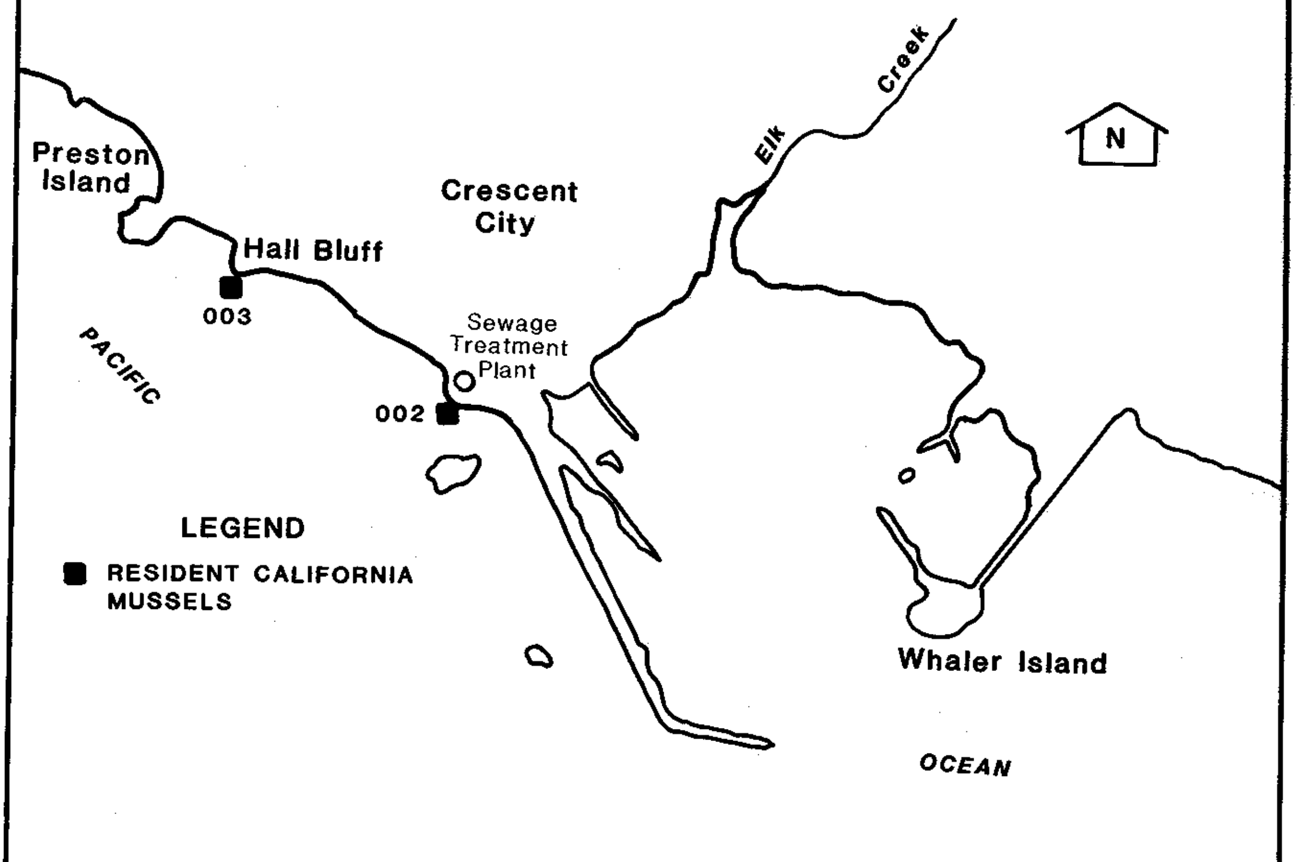

Figure 3. 1983-1984 SMW CRESCENT CITY OUTFALL SURVEY

For the 1983-84 monitoring year, a reimbursable contract was negotiated with Crescent City to provide SMW monitoring in order to fulfill the requirements of a National Pollutant Discharge Elimination System (NPDES) Permit issued to Crescent City. Under the contract, SMW samples were collected at both monitoring stations and were analyzed for trace metals and synthetic organic compounds. The results of the analyses are presented in Table 4.

In 1983-84, the level of silver in mussels collected near the outfall, at 2.49 ug/g, exceeded the 75% ETPL of 2.0 ug/g, and was over 40 times greater than the 0.06 ug/g of silver measured at the reference station. The elevated level near the outfall was, however, considerably less than the 9.9 ug/g measured during the 1982-83 monitoring year, so the source control measures for silver within the Crescent City area appear to have had a positive impact, and should be continued.

The level of mercury in mussels collected near the outfall, at 0.45 ug/g, exceeded the 75% ETPL of 0.31 ug/g, and was over twice the 0.21 ug/g of mercury measured at the reference station. However, the elevated mercury level near the outfall was slightly less than half of the 0.93 ug/g of mercury measured during the 1982-83 monitoring year. Thus, the source control measures for the discharge of silver within the Crescent City area appear to have also resulted in some reduction of mercury input to the waste treatment plant.

3.3.2 HUMBOLDT BAY BASELINE SURVEY

In cooperation with the the North Coast Regional Water Quality Control Board, SMW has sampled transplanted mussels in Humboldt Bay since 1980. Samples taken in the years 1980-1983 assisted the Regional Board in locating and controlling a discharge of silver to the Bay, identified pentachlorophenol (PCP) pollution in some areas of the Bay, and detected elevated concentrations of mercury in some samples from the Bay. In 1983-84, four transplanted mussel samples were collected in the Bay. In addition, two samples were collected from a station near the location of a future discharge from the City of Eureka's new sewage treatment facility. These latter samples established baseline conditions in the discharge area, and will be compared with future samples collected after discharge from the new treatment facility begins. A third sample was taken in 1983-84 in the southern portion of Humboldt Bay, to serve as a control for the City of Eureka discharge station. This mussel watch monitoring of the new City of Eureka discharge is being accomplished by SMW under an agreement with the City of Eureka and is a requirement of the City's NPDES permit for the discharge.

All six stations sampled in Humboldt Bay in 1983-84 are shown in Figure 4. Results of the sampling at the four regular SMW stations, and results from the two City of Eureka stations, are discussed together in the following sections.

3.3.2.1 Mercury in Humboldt Bay

From 1980-83, there were three stations where mercury concentrations exceeded the ETPL 90 for transplanted California mussels. Samples from the Samoa Bridge West station (101.0) exceeded the ETPL 90 twice, and samples from the Samoa Bridge East station (102.0) and the Eureka Channel station (103.0) each exceeded the ETPL 90 once. While neither of the latter stations were sampled in 1983-84, none of the seven samples taken from the six stations in Humboldt Bay exceeded the ETPL 75 or the ETPL 90 for mercury in transplanted California mussels. The results of the 1983-84 survey thus indicate that mercury was not significantly elevated above other areas of the state during the sampling period. Discussion of this subject in the 1981-83 SMW report indicated that elevated mercury concentrations might be correlated with periods of high rainfall and high runoff.

The 1983-84 samples, however, were exposed to significant periods of high rainfall and high runoff. Since these samples did not accumulate elevated concentrations of mercury, the source of the high concentrations of mercury detected in the years 1980-83 may not necessarily be related to rainfall or runoff. Additional SMW sampling is necessary to better define the extent and possible sources of mercury contamination in Humboldt Bay.

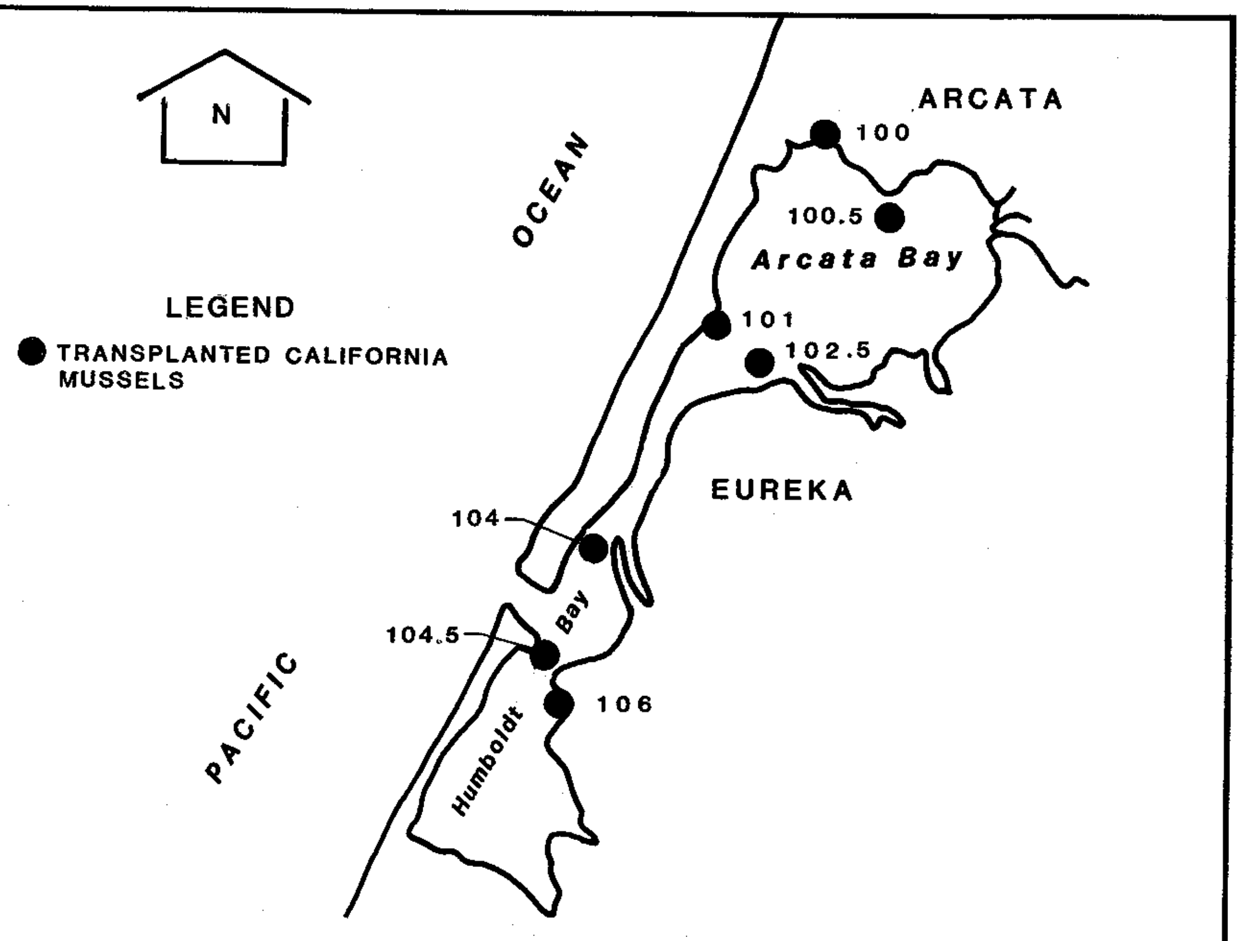

Figure 4. 1983-1984 SMW HUMBOLDT BAY SURVEY

3.3.2.2 Pentachlorophenol in Humboldt Bay

Samples taken from Humboldt Bay in the 1982-83 SMW program were analyzed for pentachlorophenol (PCP) and tetrachlorophenol (TCP) for the first time. The SMW program also analyzed for these compounds in 1983-84. Results from both years are shown in Table 8.

Table 8: PCP and TCP in Humboldt Bay

Station No.	Station Name	Date Collected	Wet Weight Multiplier	PCP	TCP
100.0	Mad River Slough	16 Dec 1982	0.163	85	D
101.0	Samoa Bridge West	16 Dec 1982	0.152	8.0	D
103.0	Eureka Channel	16 Dec 1982	0.154	4.5	D
100.0	Mad River Slough	15 Feb 1984	0.161	960	93
100.5	Arcata Dock	15 Feb 1984	0.171	120	23
101.0	Samoa Bridge West	15 Feb 1984	0.158	380	38
102.5	Woodley Island	15 Feb 1984	0.153	140	18
104.5	Eureka Treatment Plant Control	15 Feb 1984	0.131	4.6	D

All results are expressed as ng/g (dry weight) in transplanted California mussels.
D=not detected
To convert dry weight values to wet weight values, multiply the dry weight value by the wet weight multiplier

The results of the surveys indicate that a significant source of PCP and TCP exists in the northern portion of the Bay. Using this information, the Regional Board located a major source of these compounds adjacent to Mad River Slough. Under the direction of the Regional Board, this source is now in the process of taking corrective actions to prevent the future discharge of PCP and TCP to Humbolt Bay. The Regional Board is also trying to locate other sources of these compounds in the Humboldt Bay area. Future SMW monitoring will help determine the effectiveness of the corrective actions being taken at the Mad River Slough source, and will help to locate and identify any remaining sources of PCP and TCP in Humboldt Bay.

3.3.2.3 Chromium in Humboldt Bay

SMW samples taken in 1983-84 found elevated concentrations of chromium throughout Humboldt Bay. Samples from the Mad River Slough station (100.0) exceeded the ETPL 75 for chromium and for copper. Five of the other six samples taken from Humboldt Bay in 1983-84 exceeded the ETPL 90 for chromium in transplanted California mussels. The second, third, and fourth highest chromium concentrations ever found in transplanted California mussels by the SMW were found in the 1983-84 samples from the Woodley Island station (102.5), the Eureka Treatment Plant station (104.0) and the Samoa Bridge West station (101.0), respectively. Chromium contamination in Humboldt Bay in 1983-84 was greater and more extensive than in any other area ever sampled by the SMW program.

The source or sources of these high chromium concentrations are not presently known. Potential sources include chromium products used in cooling systems or as wood preservatives, and chromium derived from erosion or leaching of soils that contain natural deposits of chromium and chromium compounds. Because the Woodley Island station had the highest concentration of chromium, it is possible that the new marina in this area, with its extensive use of treated wood products, is contributing to the elevated chromium concentrations that were observed here. Because this evidence of chromium contamination at such high levels was found too late to influence the 1984-85 SMW station locations, development of an expanded sampling program for chromium will have to wait for the 1985-86 sampling year. However, the high levels observed appear to warrant a serious effort on the part of SMW and the Regional Board to locate and identify the sources so that they can be regulated.

3.3.2.4 Alpha-HCH in Humboldt Bay

Samples taken in previous years had detected high concentrations of alpha hexachlorocyclohexane (alpha-HCH) in Humboldt Bay. 1983-84 samples confirmed these earlier findings. Humboldt Bay is the only area statewide where SMW samples have shown consistantly elevated concentrations of alpha HCH, and where alpha HCH has been found in detectable concentrations in every sample where alpha HCH was looked for. Table 9 lists the alpha HCH concentrations found in Humboldt Bay transplanted mussels by the SMW program:

Table 9. ALPHA HCH IN HUMBOLDT BAY

		Alpha-HCH (ng/g dry weight)				
Sta. No.	Name	1979-80	1980-81	1981-82	1982-83	1983-84
100.0	Mad River Slough				7.4**	4.4
100.5	Arcata Dock					5.2*
101.0	Samoa Bridge West	7.1*	5.0		12.0**	
102.0	Samoa Bridge East		2.7	4.6		
102.5	Woodley Island					4.0
103.0	Eureka Channel		5.2*		8.4**	
104.0	Eureka Treatment Plant					5.5*/5.8*
104.5	Eureka Treatment Plant Control					4.7
106.0	Fields Landing			2.6		

Note: * - Exceeds ETPL 75
** - Exceeds ETPL 90
All Values Reported Are In Transplanted California Mussels

The 12.0 ng/g alpha-HCH found in the sample from the Samoa Bridge West station in December 1982 is the highest value ever recorded by the SMW program in transplanted mussels. Taken together, these results indicate that Humboldt Bay consistantly contains significantly elevated concentrations of alpha-HCH. The source or sources of this contamination are at present unknown. Further SMW monitoring should shed more light on the likely sources of alpha-HCH in Humboldt Bay.

3.3.3 EUREKA SEWAGE TREATMENT PLANT OUTFALL SURVEY

Within Humboldt Bay, SMW monitoring of the City of Eureka's Elk River Wastewater Treatment Plant outfall has been conducted under a reimbursable contract.

The material for this section falls logically within the treatment of Humboldt Bay in the preceding Section 3.3.2 and is discussed in detail therein. This work was performed for the City of Eureka pursuant to the monitoring provisions of its NPDES permit, as a result of negotiations with the North Coast Regional Water Quality Control Board.

3.3.4 SAN FRANCISCO BAY BASELINE SURVEY

SMW monitoring in San Francisco Bay began in 1979-80 using resident Bay mussels and transplanted California mussels at stations sited away from major wastewater outfalls in order to establish baseline levels of pollutants. The most notable previous finding in the Bay was elevated silver levels near the mouth of Redwood Creek. An intensive survey of the Redwood Creek drainage conducted by SMW from 1981 to 1983 led to a preliminary conclusion that the most probable cause was a sewage discharge diverted temporarily through the old and long unused Redwood City outfall while the normally used deepwater outfall serving Redwood City and other nearby communities was shut down from August through November, 1981. Results from 1983 indicate that the elevated silver levels within the Redwood Creek drainage have declined.

Figure 5 shows the location of the five SMW monitoring stations located in San Francisco Bay during the 1983-84 monitoring year. Transplanted California mussels from these stations revealed that San Francisco Bay is, on the whole, a relatively clean water body, with the exception of the following elevated levels of trace metals.

The 90% ETPL of 12.2 ug/g for cadmium was exceeded at all SMW monitoring stations in the southern portion of San Francisco Bay. The San Mateo Bridge station (309.0) had 13.0 ug/g of cadmium, the Redwood Creek North station (313.0) had 12.2 ug/g of cadmium, and the Dumbarton Bridge station (321.0) had 15.7 ug/g of cadmium. Point Pinole (Station 302.0) in the northern end of the Bay and Treasure Island (Station 307.0) in the central section of the Bay had lower levels of cadmium, although the concentration at Point Pinole (11.8 ug/g) exceeded the 75% ETPL of 10.6 ug/g for cadmium. The 1983-84 levels are slightly less than those measured by SMW in previous years. However there is a geographic trend of increasing cadmium levels as one moves south in the Bay. This may be due to both use of the metal and hydraulic characteristics of the Bay. Metallic cadmium, as described previously, is used in alloy manufacture,

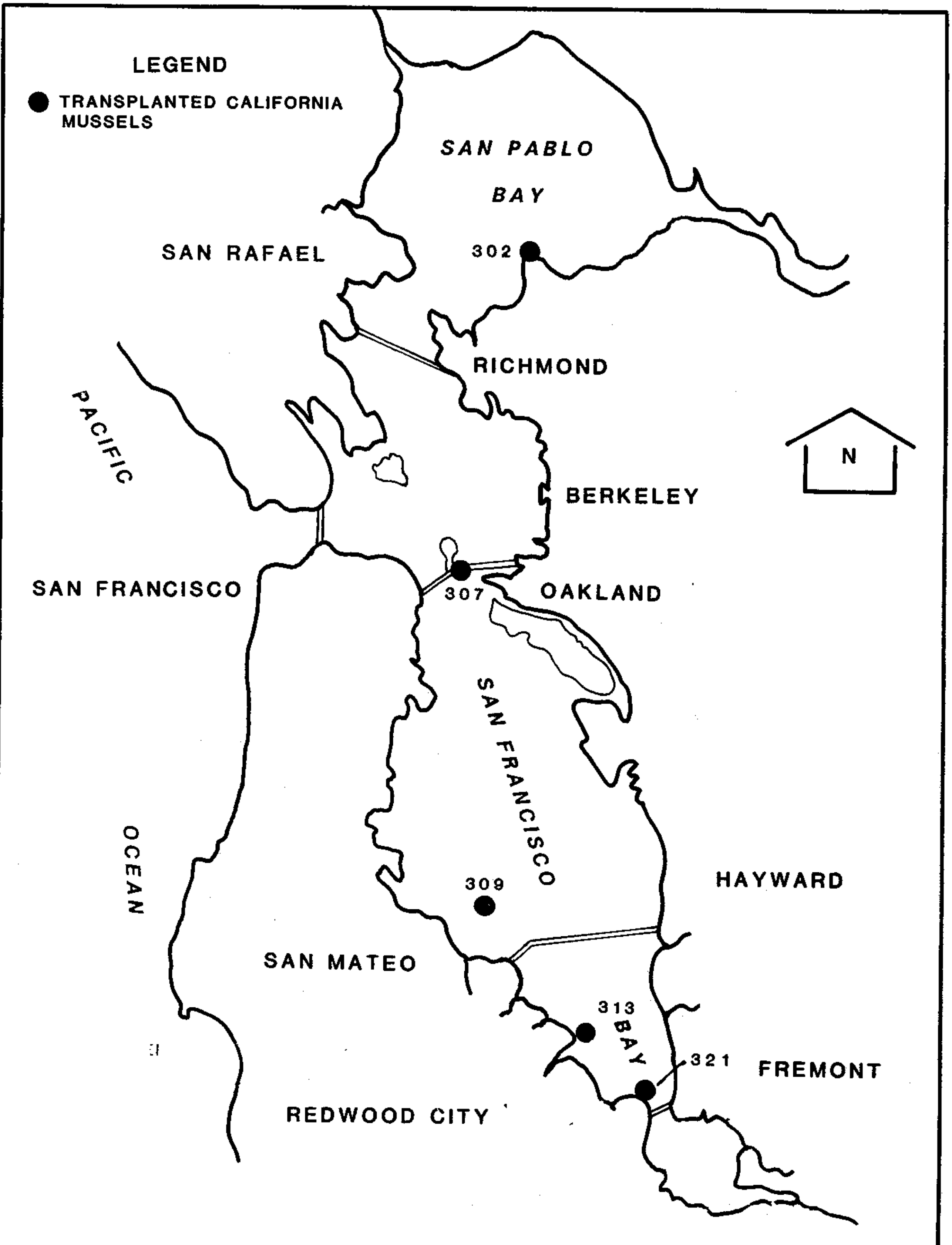

Figure 5. 1983-1984 SMW SAN FRANCISCO BAY SURVEY

electroplating, ceramics, pigmentation, and photography. Cadmium salts may be found in wastes from electroplating plants, pigment works, textile printing, and chemical industries (McKee and Wolf, 1963). The volume of municipal wastewater discharged into the South Bay is at least four times greater than into the North Bay (Bradford and Luoma, 1980) thus exposing the South Bay transplants to higher levels of trace metals associated with these discharges. Also, the South Bay suffers from limited flushing which results in reduced water circulation when compared to the North Bay. The reduced circulation and the higher levels of pollutants in the South Bay appear to have interacted to cause transplanted mussels to accumulate more elevated levels of cadmium.

The Dumbarton Bridge station (321.0) also had levels of chromium, zinc, and mercury that exceeded the 90% ETPLs for these metals, and levels of manganese that exceeded the 75% ETPL for that metal. The San Mateo Bridge station (309.0) showed similar results with chromium, manganese, and zinc exceeding the 75% ETPLs for these metals. The use of these metals and their salts in various industrial processes and their subsequent presence in municipal discharges, coupled with the reduced circulation in the south Bay, could account for the elevated levels at these South Bay SMW monitoring stations.

The Treasure Island station (307.0) had elevated levels of aluminum, chromium, and mercury that exceeded the 90% ETPLs for these trace metals, and elevated levels of zinc that exceeded the 75% ETPL. The Treasure Island Station is near the Ports of Oakland and San Francisco in an area where a considerable amount of industrial production, product transfer, and product storage occurs. In addition, circulation of waters passing through the industrialized areas of Antioch, Pittsburg, Benicia, and Hercules could have contributed to the elevated levels of these metals in the central portion of San Francisco Bay.

The Point Pinole Station in the northern portion of the Bay had levels of chromium, as well as cadmium, that exceeded the 75% ETPLs for these metals. The 0.50 ug/g of mercury measured there exceeded the 90% ETPL of 0.41 for mercury and was exceeded within the Bay only by the 0.68 ug/g measured at the Dumbarton Bridge station. Although several ETPLs for metals were exceeded in 1983-84, levels were, with the exception of chromium, about the same or less than they have been previously. The elevated levels of trace metals within the Bay appear to be a long standing condition due principally to point sources of municipal and industrial pollution. In future years, work within the Bay must be expanded to examine areas specifically suspected of being sources for metallic or organic pollutants.

San Francisco Bay also exhibited levels of three synthetic organic substances that exceeded 75% or 90% ETPLs. Another synthetic organic substance showed a distinctive pattern of increasing concentrations as one moves southward in the Bay.

The levels of dieldrin in transplanted mussels at all stations within the Bay exceeded the 75% ETPL of 35.0 ng/g with the levels at the three south Bay stations exceeding the 90% ETPL of 62.6 ng/g. Dieldrin is a chlorinated hydrocarbon compound with carcinogenic potential that has been widely used as a domestic pesticide. Dieldrin levels in the aquatic environment are also linked to the use of aldrin as a domestic pesticide. Aldrin is metabolically converted in the environment to the more stable dieldrin. This conversion has been shown to occur in several species of diverse organisms including mammals, birds, insects, and freshwater fish (Gakstatter, 1968). The persistence of

The endosulfan I measured within San Francisco Bay could have been applied

3.3.5 MOSS LANDING HARBOR DRAINAGE PESTICIDE SURVEY

The 1982-83 site specific survey in the Moss Landing drainage area was continued in 1983-84 to investigate the occurrence of relatively elevated concentrations of toxaphene, endosulfan I and DDT. Elevated levels of these pesticides were first detected by baseline monitoring under the 1981-82 SMW program, and these findings were confirmed in the 1982-83 survey. The 1983-84 survey has further confirmed the results of the 1982-83 survey, identified dacthal as an additional chemical of concern, and has provided information which will enable us to determine the distribution of these four pesticides within the drainage area.

Because of the wide range in salinities within the Moss Landing Harbor Drainage area, the 1983-84 monitoring program consisted of freshwater fish and clam samples in addition to an expanded network of mussel monitoring stations in saline areas. Figure 6 shows the location of the Moss Landing Harbor Drainage stations. The 1983-84 program in this area was jointly developed and implemented by SMW and the Central Coast Regional Water Quality Control Board. Samples were collected at the TSM stations shown on this figure by the Toxic Substances Monitoring (TSM) program of the State Board. The 1983-84 TSM Program Report (SWRCB Water Quality Monitoring Report 85-1 TS) discusses the TSM results in detail (Agee et al., 1985).

The complete summary of SMW monitoring data for the Moss Landing Harbor drainage is listed in Table 4. Selected results from the 1983-84 SMW and TSM studies in the area, which were closely coordinated, are summarized in Table 10. The following discussion of results covers toxaphene, endosulfan, DDT, and dacthal in separate sections.

3.3.5.1 Toxaphene

Toxaphene, a chlorinated camphene containing approximately 68% chlorine, is widely used as an agricultural insecticide because of its high solubility in organic solvents and oils. A total ban by EPA on the use of toxaphene as a crop insecticide is scheduled to take effect in 1986. Existing stocks of this insecticide are presently being used on row crops and on livestock to control ticks and flies. Alfalfa, tomatoes, broccoli, beans, lettuce, cauliflower and onions were some of the major crops treated with toxaphene in 1983 (CDFA, 1983). Toxaphene was found in exceptionally high levels in resident and transplanted mussels and clams from portions of the Moss Landing Harbor Drainage area. This occurrence was not unexpected as levels had been found to be high in previous SMW monitoring efforts (Ladd, et al., 1984), and because toxaphene is highly soluble in lipids and can therefore be bioaccumulated. The finding of 22,000 ng/g (2,288.0 ng/g wet weight) of toxaphene in freshwater clams transplanted in Espinosa Slough is the highest ever found in the SMW program. This measurement, although exceptionally high, should be interpreted with caution as the "control" clams obtained from the Delta-Mendota Canal near Westley had baseline levels of 7,700 ng/g (993.3 ng/g wet weight) of toxaphene present in their tissue. Water from the San Joaquin River makes up a significant portion of the water transported south though the Delta-Mendota Canal. Previous TSM studies (LaCaro et al., 1983, Agee et al., 1985) have shown that fish from the San Joaquin River at Vernalis (near the intake structure of the Delta-Mendota Canal) have had elevated levels of toxaphene.

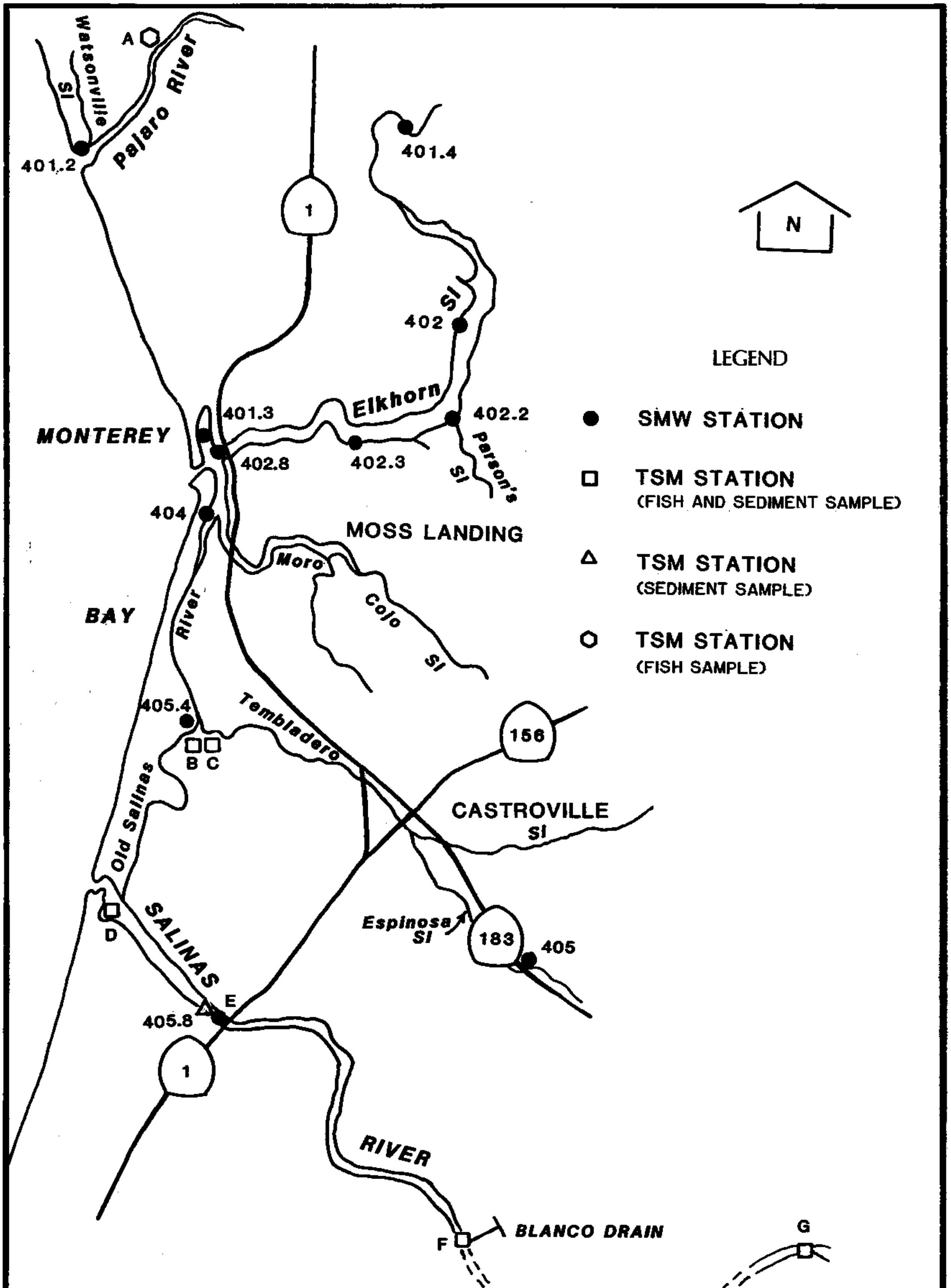

Figure 6. 1983 - 1984 STATION LOCATIONS IN THE MOSS LANDING HARBOR DRAINAGE AREA

ulfan, and DDT concentrations from the Moss Landing Harbor Drainage Area - 1983-84

le e[1]	Wet Weight Multiplier[3]	Toxaphene	Total Endosulfan[5]	DDT	DDD	DDE	Total DDT[6]
		Synthetic Organic Substances (ng/g dry weight)					
M	0.166	1300	3390	610	970	1632	3244
M	0.117	1800	10600	1010	830	1834	3719
M	0.115	400	1830	169	253	716	1154
M	0.140	200	1700	88	109	225.5	432.5
S	0.080	370	85	176	104	627.7	907.7
C	0.113	200	138	25	27	220	272
C	0.109	250	123	34	12	96	142
M	0.137	1300	7200	430	1360	1732	3538
C	0.104	22000	24500	6140	5260	9610	21051
C	0.100	7600	10500	3860	3210	8330	15510
C	0.093	8100	720	2010	2020	4840	8904
C	0.129	7700	680	1600	526	4990	7149
R	0.202	D[4]	D	129	79	351	559
B[2]	0.250	8800	3364	1172	2560	6060	10016
R	0.167	D	52.7	102	431	491	1024
R	0.190	D	D	179	116	384	679
R	0.201	4328	D	2796	1512	4925	9338
R	0.197	D	D	96	ND	375	472
D		D	111.0	25.2	118.0	102.6	248.7
D		D	108.0	17.4	146.0	90.5	256.6
D		D	D	7.5	6.4	6.8	20.7
D		D	18.3	28.5	28.6	46.0	103.1
D		210	D	113.0	111.0	86.3	310.7
D		D	D	2.4	7.2	5.4	15.0

fornia Mussel, RBM-Resident Bay Mussel, OYS-Oyster, BNC-Bentnose Clam, LNC-Little-
eshwater Clam, SKR-Sucker, STB-Stickleback, SED-Sediment
cker-flesh (fillet) analysis only
weight values, multiply the dry weight value by the wet weight multiplier.

an I and II, and endosulfan sulfate.
untabulated DDMU and DDMS.

Future surveys will use clams from sources removed from agricultural influence such as San Antonio Reservoir. Nonetheless, the toxaphene measurement in Espinosa Slough is approximately three times that measured in the Westley control clam population, and indicates significant input of toxaphene to the Slough.

Other portions of the Moss Landing Harbor Drainage area also had elevated levels of toxaphene. Resident Bay mussels from the Yacht Harbor Station (401.3) and Sandholdt Bridge Station (404.0) had 1,800 ng/g (210.6 ng/g wet weight) and 1,300 ng/g (178.1 ng/g wet weight) of toxaphene respectively. These high values are significant because they are near the mouth of the drainage area and represent the end result or cumulative effects of the toxaphene input to the entire area.

Within Elkhorn Slough, oysters from Pacific Mariculture (Station 402.3) had 370 ng/g (29.6 ng/g wet weight) of toxaphene, and transplanted California mussels from Kirby Park (Station 401.4) and Parsons Slough (Station 402.2) had 400 ng/g (46.0 ng/g wet weight) and 200 ng/g (28.0 ng/g wet weight) of toxaphene respectively in their tissues. Although these values seem low in comparison to all previously described values, they all exceed the 75% ETPL of 60 ng/g for toxaphene, and the Kirby Park and Pacific Mericulture values exceed the 90% ETPL of 260 ng/g for toxaphene. The SMW results in total, therefore, indicate exceptionally high levels of toxaphene in the biota of the drainage area.

Exceptionally high levels of toxaphene were also found in Watsonville Slough (Station 401.2) which drains into the mouth of the Pajaro river north of the Moss Landing Drainage area. The 1,300 ng/g (215.8 ng/g wet weight) of toxaphene found in California mussels transplanted into this area was especially significant because no toxaphene was detected in suckers obtained from the Pajaro River upriver from the transplant station. Thus, the input of toxaphene appears to be coming from within the drainage area of the Watsonville Slough.

Toxaphene was found in fish tissue on only fifteen occasions under the 1983-84 TSM program, and two of these occasions were in the Moss Landing Harbor Drainage area. The toxaphene levels measured in whole body stickleback from the Old Salinas River (8,800 ng/g dry weight or 2,200 ng/g wet weight) and in filets from suckers from the Blanco Drain (4,328 ng/g dry weight or 870.0 ng/g wet weight) were higher than most of the SMW measurements, and exceeded the 90% ETPL for toxaphene in the TSM program. Most importantly, the TSM findings of toxaphene in the drainage support and confirm the findings of the SMW program.

Toxaphene does not appear to be locked in the sediments of the drainage in signficant concentrations. It was detected in only one of the six TSM sediment samples analyzed in 1983-84. Although toxaphene is lipid soluble and can be present in organic matter, it is insoluble in water. Therefore, it is not surprising that sediment samples that are low in organic matter and have been dessicated contain little or no measurable toxaphene. The Drainage sediment samples appear to fall into this category.

3.3.5.2 Endosulfan

Endosulfan is a broad spectrum insecticide that belongs to the group of polycyclic chlorinated hydrocarbons called cyclodiene insecticides. Technical grade endosulfan has a purity of 95% and is composed of a mixture of two steroisomers present in the ratio of 70% isomer I (endosulfan I) and 30% isomer II (endosulfan II). Both isomers are metabolized to endosulfan sulfate by a wide variety of organisms (Maier-Bode, 1968). Endosulfan is used primarily on artichokes, tomatoes, alfalfa, and lettuce, and to a lesser extent on melons, almonds, beans, celery, strawberries, and dozens of other crops (CDFA, 1983).

Endosulfan, like toxaphene, was found in exceptionally high levels in resident and transplanted mussels and clams from portions of the Moss Landing Harbor Drainage. Once again, such an occurrence is not surprising since previous SMW monitoring efforts had shown high endosulfan levels (Ladd et al., 1984), and because endosulfan is lipid soluble and can therefore be bioaccumulated.

The pattern of concentrations of endosulfan within the Drainage was similar to the pattern demonstrated by toxaphene. Like toxaphene, endosulfan was found at its highest concentration of 24,500 ng/g (2,548.0 ng/g wet weight) in freshwater clams transplanted in Espinosa Slough. This was the highest ever reported in the history of the SMW program. This measurement is also over 36 times the baseline level of 680 ng/g (87.7 ng/g wet weight) of endosulfan found in the control clams obtained from the Delta-Mendota Canal near Westley. The Westley baseline endosulfan measurement, although elevated over the endosulfan measurements in oysters, bentnose clams, and littleneck clams from the Elkhorn Slough, was less than all of the measurements in the transplanted freshwater clams from the Espinosa Slough, Salinas River, and Old Salinas River. The SMW freshwater clam transplant effort in the southern portion of the Drainage has shown that a significant input of endosulfan into the Espinosa Slough has occurred.

Other portions of the Drainage also had elevated levels of endosulfan. Resident Bay mussels from the Yacht Harbor Station (401.3) and Sandholt Bridge Station (404.0) had 10,600 ng/g and (1,240.2 ng/g wet weight) and 7,200 ng/g (986.4 ng/g wet weight) of endosulfan respectively. The Sandholt Bridge value was six times the 1982-83 SMW value of 1,200 ng/g (134.4 ng/g wet weight) in resident Bay mussels. These highly elevated endosulfan values, like those of toxaphene, are significant for two reasons. First, the Sandholt Bridge results indicate that endosulfan input is continuing and may be increasing over time within the Drainage. Secondly, elevated endosulfan values at these drainage mouth stations represent the cumulative effects of endosulfan input to the entire area.

Within Elkhorn Slough, transplanted California mussels at Kirby Park (Station 401.4) and Parson's Slough (Station 402.2) had 1,830 ng/g (210.4 ng/g wet weight) and 1,700 ng/g (238.0 ng/g wet weight) of endosulfan, respectively, in their tissues. The 1983-84 endosulfan value at Kirby Park is over four times the 1982-83 SMW value of 430 ng/g (74.4 ng/g wet weight), and the 1983-84 endosulfan value at Parsons Slough is almost six times the 1982-83 SMW value of 290 ng/g (40.3 ng/g wet weight) indicating an increase of endosulfan input to Elkhorn Slough.

Both the Kirby Park and Parson's Slough endosulfan values far exceeded the 90% ETPL of only 24.6 ng/g for endosulfan. The magnitude by which measurements of endosulfan in transplanted California mussels exceed the 90% ETPL indicate how exceptionally high the endosulfan values are within the drainage. ETPLs have not been calculated for resident Bay mussels because of insufficient data. However, if ETPLs had been calculated for these mussels, the exceptionally high levels measured at Sandholt Bridge and the Yacht Harbor (7,200 ng/g and 10,600 ng/g respectively or 986.4 ng/g and 1240.2 ng/g wet weight respectively) would undoubtedly have exceeded the 90% ETPL for the Bay mussel.

The 1983-84 SMW results for endosulfan in the Drainage indicate exceptionally high levels of endosulfan in fresh water clams, resident Bay mussels, and transplanted California mussels. In addition, the results indicate increasing endosulfan levels within the Drainage when compared to the 1982-83 SMW results in this area.

As with toxaphene, exceptionally high levels of endosulfan were also found in Watsonville Slough (Station 401.2). The 3,390 ng/g (562.7 ng/g wet weight) of endosulfan measured in transplanted California mussels is significant because endosulfan was not detected by the TSM program in suckers from the nearby Pajaro River station (Station A). Thus, as with toxaphene, the input of endosulfan appears to be coming from within the drainage area of the Watsonville Slough. Additionally, the 1983-84 Watsonville Slough endosulfan

The pattern of concentrations of total DDT within the Drainage was similar to the patterns demonstrated by endosulfan and toxaphene. Like endosulfan and toxaphene, total DDT, DDT, DDE and DDD were found at their highest concentrations in freshwater clams transplanted in the Espinosa Slough. The total DDT measurement of 21,051 ng/g (2,189.3 ng/g wet weight) there is the highest ever reported by the SMW program. A similar level of 15,510 ng/g (1,551.0 ng/g wet weight) of total DDT was also found in the Old Salinas River. As with toxaphene and endosulfan, one must use caution in interpreting these results because the baseline level of total DDT in clams from the Westley control station was 7,149 ng/g (922.2 ng/g wet weight). This is approximately one-third the Elkhorn Slough measurement and one-half the Old Salinas River measurement, and incidentally indicates the degree to which the waters of the Delta-Mendota Canal convey pesticides. Nonetheless, the SMW transplanting effort in the Drainage, using freshwater clams, has shown that significant amounts of DDT were transported to the Elkhorn Slough and Old Salinas River at some time in the past. This has resulted in an expansion of the use of freshwater clams in the Drainage by SMW in 1984-85.

Resident Bay mussels from the Yacht Harbor station (401.3) and Sandholt Bridge station (404.0) had 3,719 ng/g (435.1 ng/g wet weight) and 3,538 ng/g (484.7 ng/g wet weight) of total DDT respectively. The 1983-84 Sandholt Bridge value, although elevated, is marginally less than the 1982-83 value of 4,500 ng/g (558.0 ng/g wet weight) total DDT. The elevated values are significant, however, because both the Yacht Harbor and Sandholt Bridge are located near the mouth of the entire Drainage, and represent the cumulative effects of DDT input to the entire area.

Within Elkhorn Slough, relatively low levels of total DDT and its degradation products were detected. Transplanted California mussels at the Kirby Park station (401.4) and Parson's Slough station (402.2) had 1,154 ng/g (132.7 ng/g wet weight) and 432.5 ng/g (60.6 ng/g wet weight) of total DDT respectively in their tissues. Both of these values fall below the 75% ETPL of 1,158 ng/g for total DDT. Curiously, the Kirby Park value is over three times the 1982-83 SMW value of 320 ng/g, (44.5 ng/g wet weight) and the Parson's Slough value is less than half the 1982-83 SMW value of 940 ng/g (130.7 ng/g wet weight) total DDT. Low DDT levels were found in Elkhorn Slough at the remaining sampling locations. Oysters from Pacific Mariculture station (402.3) had 907.7 ng/g (72.6 ng/g wet weight) of total DDT and bentnose clams and littleneck clams from Skippers station (402.8) had 272 ng/g (30.7 ng/g wet weight) and 142 ng/g (15.5 ng/g wet weight) of total DDT respectively in their tissues.

As with toxaphene and endosulfan, exceptionally high levels of total DDT were found in transplanted California mussels from the Watsonville Slough station (401.2). The 3,244 ng/g (538.5 ng/g wet weight) of total DDT found there exceeds the 90% ETPL of 1,930.6 ng/g for total DDT in transplanted California mussels. Low levels of total DDT (559 ng/g) were detected by the TSM program in 1983-84 in suckers from the nearby Pajaro River station (Station A). Thus, as with toxaphene and endosulfan, the input of DDT appears to be coming from within the drainage area of the Watsonville Slough.

DDT was found in fish tissue in every 1983-84 TSM sample in the area. As with the SMW freshwater clam transplants, high total DDT levels were found in stickleback from the Old Salinas River (10,016 ng/g dry weight or 2,504 ng/g wet weight). However, the analyses by TSM were conducted on the whole body rather than on flesh filets only, so the value may be artificially elevated over other TSM analyses within the drainage, which were conducted on sucker filets only. Nonetheless, the Old Salinas River appears to have elevated levels of total DDT within its waters as indicated by both the TSM and SMW programs.

DDT is present in the sediment throughout the Drainage. The 1983-84 TSM sediment samples showed that DDT is highest in sediment from the Old Salinas River, Lower Tembladero Slough, and the Blanco Drain. Not surprisingly, bottom and detritus feeders such as suckers, and filter feeders such as mussels and clams, are able to bioconcentrate and bioaccumulate DDT within the drainage from such a sediment source.

Technical grade DDT is a mixture of approximately 80 percent p-p' DDT and 15 to 20 percent o-p' DDT with impurities making up the remaining percentage. Once in the environment, these isomers of DDT break down primarily to DDD and DDE. The ortho-para isomer of DDT (o-p' DDT) is generally thought to be less stable than the para-para isomer (p-p' DDT) and so is thought to be converted to DDD and DDE more rapidly than p-p' DDT. This is especially true once DDT enters aquatic systems or is ingested by fish. Because of this degradation process, "recently mobilized" total DDT usually has a ratio of isomers close to that of technical grade DDT. Total DDT measurements of "older" DDT would have very little DDT (especially o-p' DDT) and would have considerably more DDD or DDE. Similarly, if stored DDT were recently disturbed or mobilized, then the same rules should apply after the DDT entered the aquatic system.

Staff of the State Water Resources Control Board have proposed criteria for determing whether DDT is recently mobilized or whether it has been in the environment for a while. Three of these criteria are as follows:

the pp' isomers in Total DDT.

Criterion 2: op'+pp' DDT (Technical DDT) comprises at least 10% of the Total DDT measured.

Criterion 3: op' DDT comprises at least 8% of op'+pp' upper Elkhorn Sloughs had tissue DDT compositions that exeeded at least two of these criteria. Thus, the possibility of recently mobilized DDT may exist in these portions of the Drainage.

Recently mobilized DDT may also exist in the southern portion of the Drainage. Fresh water clams transplanted in Espinosa Slough, Old Salinas River, and the Salinas River Lagoon had tissue DDT compositions that also exceeded at least two of the criteria. These results must be interpreted with some caution as the control clams from the Delta-Mendota Canal near Westley, and outside of the Drainage area, also exceeded these criteria. However, the total DDT levels doubled in clams transplanted at Old Salinas River and tripled in clams transplanted at Espinosa Slough without a significant change in the isomer composition described previously.

Table 11. An Evaluation of DDT Data in Moss Landing Harbor Drainage Versus Three Criteria

Station Name	Number	Criteria Exceeded 1	2	3	No. of Criteria Exceeded
Watsonville Sl.	401.2	X	X	X	3
Yacht Harbor	401.3	X	X	X	3
Kirby Park	401.4		X	X	2
Parsons Sl.	402.2	X	X	X	3
Pacific Mariculture	402.3		X	X	2
Skippers*	402.8				0
Skippers	402.8	X	X		2
Sandholt Br.	404.0		X		1
Espinosa S.	405.0	X	X		2
Old Salinas R.	405.4	X	X	X	3
Salinas R. Lag.	405.8	X	X	X	3
Westley Station	406.0	X	X	X	3

*Each station is listed once for each sample. Multiple station listings represent multiple samples.
Criterion 1-pp' DDT/all pp' isomers in Total DDT greater than 15%
Criterion 2-op' + pp' DDT/Total DDT greater than 10%
Criterion 3-op' DDT/op'+pp' DDT greater than 8%.

3.3.5.4 Dacthal

In 1983-84, SMW sampling identified dacthal as an additional chemical of concern in the Moss Landing Harbor area. Table 12 lists the samples for which dacthal has been analyzed in this area since monitoring began in 1979. The 1983-84 sampling program included five mussel samples, four freshwater clam samples, one oyster sample, and two salt water clam samples. Since the SMW program had not sampled freshwater or saltwater clams before, there is no data with which to compare the 1983-84 results. However, the three freshwater clam samples had the three highest concentrations of dacthal ever measured by the SMW program. As these clams contained undectectable concentrations of dacthal before they were deployed in the Moss Landing Harbor Drainage area, it is apparent that there is a significant source of dacthal in this area.

Similarly, the five 1983-84 mussel samples from this area had the five highest concentrations of dacthal ever found in mussels by the SMW program. Thus, the eight highest concentrations of dacthal ever found by the SMW program were all found in the 1983-84 sampling program in the Moss Landing Harbor Drainage area.

There are no U.S.F.D.A. public health action levels or tolerances for dacthal in fish or shellfish, and no agency has established body burden standards for dacthal for the protection of fish and wildlife. It is therefore difficult to assess the significance of these 1983-84 findings. The SMW program should continue to sample for dacthal in the Moss Landing Harbor Drainage area in future years. If concentrations continue to increase or remain at elevated levels, additional work to locate sources of dacthal and to identify potential source control measures may be needed.

Table 12. Dacthal in the Moss Landing Harbor Area

Station Number	Station Name	Type	Date Collected	Wet Weight Multiplier	Dacthal Concentration (ng/g dry wt.)
403.0	E. S. Highway Bridge	TCM	29 May 80	0.199	12
403.0	E. S. Highway Bridee	TCM	24 Nov 80	0.208	2.9
402.3	Pacific Mariculture	RBM	13 Feb 81	0.120	150
402.0	E. S. Duck Club	RBM	24 Feb 82	0.106	41
404.0	Sandholt Bridge	RBM	24 Feb 82	0.124	140
401.2	Watsonville Sl.	TCM	28 Nov 83	0.166	830
401.3	M. L. Yacht Harbor	RBM	28 Nov 83	0.117	2200
401.4	Kirby Park	TCM	23 Nov 83	0.115	160
402.2	Parson's Sl.	TCM	23 Nov 83	0.140	240
404.0	Sandholt Bridge	RBM	28 Nov 83	0.137	1200
405.0	Espinosa Sl.	FWC	28 Nov 83	0.104	8600
405.4	Old Salinas River Ch. 1	FWC	28 Nov 83	0.100	6700
405.8	Salinas River Lagoon	FWC	28 Nov 83	0.093	4300
406.0	Westley Station Control	FWC	28 Nov 83	0.129	D

3.3.6 MONTEREY HARBOR LEAD SURVEY

State Mussel Watch samples taken from the Monterey Peninsula area over the five-year period between 1979-1983 have contained high concentrations of lead in mussels. As sampling locations along the Peninsula approach Monterey Harbor, observed lead concentrations increase. Many mussels from the sampling stations closest to the Harbor contained lead concentrations greater than 90% of all the mussels sampled by the State Mussel Watch program. In response to these findings of highly elevated lead concentrations, the Monterey County Department of Health posted the Cannery Row area warning the public about the danger of consuming mussels taken from the area.

These findings of elevated lead concentrations suggest that a source of lead may exist in the Monterey Harbor area. Before publication of the 1981-83 SMW report, it was suspected that this source might be urban runoff, fallout from air pollution, cannery wastes, or leaded fuels from the small boat basin. Following publication of the 1981-83 report, local residents identified an additional potential source of lead. According to these residents, lead ore or slag from a lead smelter was placed along the shoreline next to the old Southern Pacific railroad tracks adjacent to Monterey Harbor many years ago. Upon identification of this additional potential source of lead, the Cannery Row area was resampled, including for the first time, Monterey Harbor itself. Figure 7 shows the location of these mussel sampling stations. The lead concentrations found in the mussels taken at these stations are shown in Table 13.

Table 13. Lead Concentrations in Mussels in Monterey Harbor Area, February 1984

Station Name	Station Number	Mussel Type	Wet Weight Multiplier	Lead Concentration (ug/g dry wt.)	Remarks
Point Pinos	411	RCM	0.158	3.2	
Pacific Grove	414	RCM	0.154	3.3	
Coast Guard	420	RCM	0.141	91.8	large sized mussels
Coast Guard	420	RCM	0.153	91.7	small sized mussels
Slag Area	421	RCM	0.137	1826.0	single mussel
Fisherman's Wharf	421.3	RCM	0.134	37.6	small sized mussels
Fisherman's Wharf	421.3	RCM	0.123	86.1	large sized mussels
Commercial Wharf	421.4	RBM	0.158	5.8	small sized mussels

RCM = resident California mussel (Mytilus californianus)
RBM = resident bay mussel (Mytilus edulis)

To convert dry weight values to wet weight values, multiply the dry weight value by the wet weight multiplier.

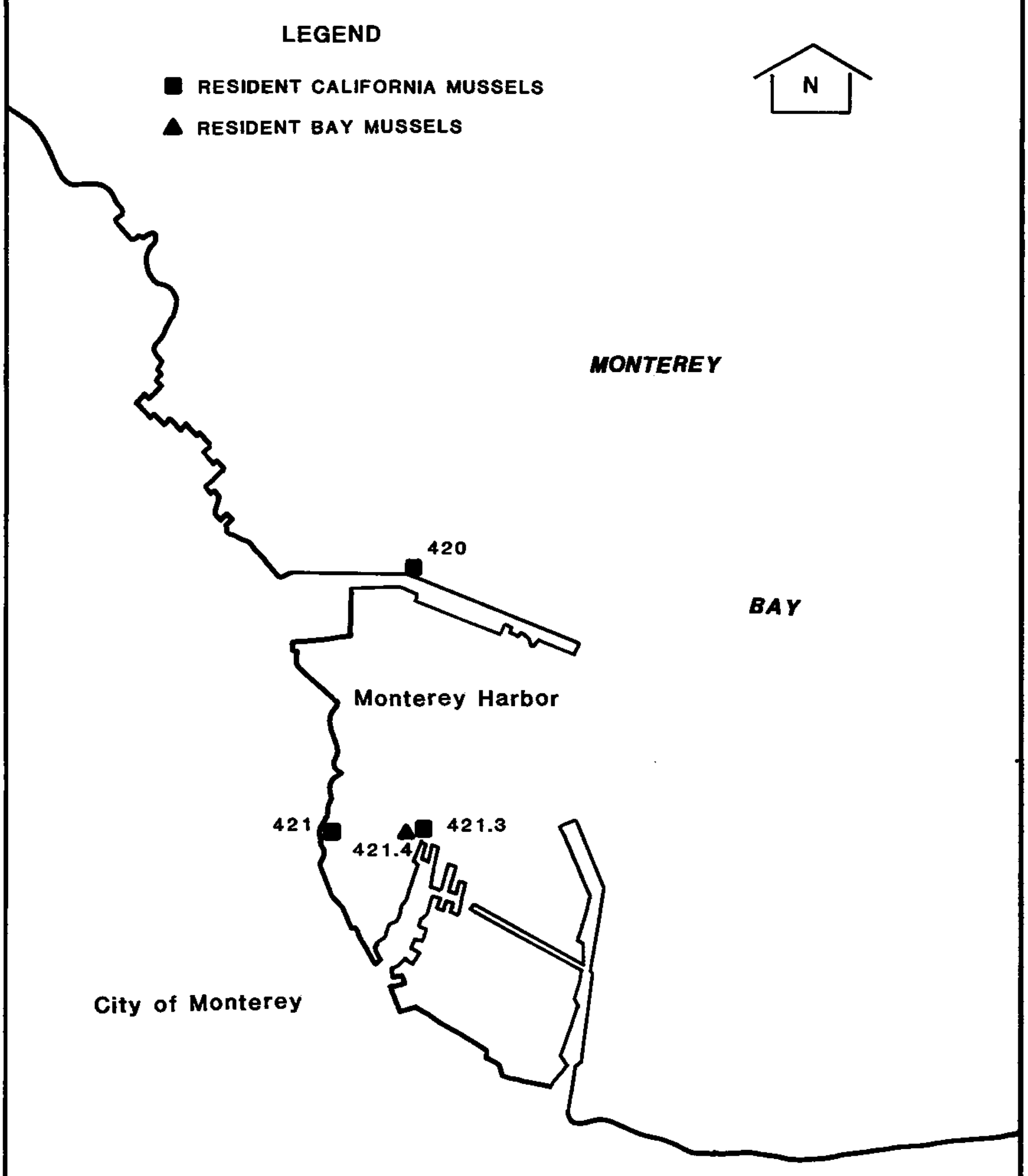

Figure 7. 1983-1984 SMW MONTEREY HARBOR LEAD SURVEY

The results of the 1983-84 Monterey Harbor site-specific survey show that lead contamination is as great or greater inside the harbor as it is at the Coast Guard area of the jetty or near Cannery Row. A single mussel taken inside the Harbor adjacent to the slag deposit had the highest lead concentration ever found by the State Mussel Watch project.

Special precautions need to be taken in interpreting these results. As the sample taken at the slag deposit was only a single mussel, it is not valid to directly compare the lead concentration of this sample to the lead concentrations of nearby samples that consisted of pooled samples of from 15-45 mussels. In addition, the samples taken from the commercial Wharf Station (Station 421.4) were bay mussels (Mytilus edulis) rather than California mussels (Mytilus californianus).

Furthermore, the bay mussels obtained were smaller than the mussels taken at the other Monterey area stations. Direct comparison of data between mussels of different sizes or species may not be valid because they may accumulate lead at different rates and to different tissue levels.

Nevertheless, due to the extraordinarily high concentrations of lead present, the slag deposit is clearly a likely source of lead contamination in Monterey Harbor. In view of the consistently elevated concentrations of lead found outside the Harbor, however, another source of lead may also be present in the Monterey area. To help answer this question, and in response to the lead contamination found in the Harbor itself, condinated actions were taken in 1983-84. First, the Monterey County Department of Health posted the Harbor area near Wharf #1, warning the public about the danger of taking mussels from the area. Second, the Regional Water Quality Control Board, Central Coast Region, ordered the City of Monterey to clean up the large pieces of slag visible in the slag deposit area. The City, as the present landowner of this area, immediately removed this material. However, the City was not required to remove or cover the remaining base fill of material in this area; only the large pieces of material were removed. Following this removal, SMW personnel collected sediment samples in the Monterey Harbor area. The location of the stations sampled are shown in Figures 8 and 9, and the results are shown in Table 14.

Lead concentrations in harbor sediments mirror the lead concentrations found in mussels, with the highest concentrations found near the slag deposit. A correlation analysis between sediment concentrations and mussel concentrations is plotted in Figure 10. This information further indicates that the slag deposit is a major source of lead to the Monterey marine environment.

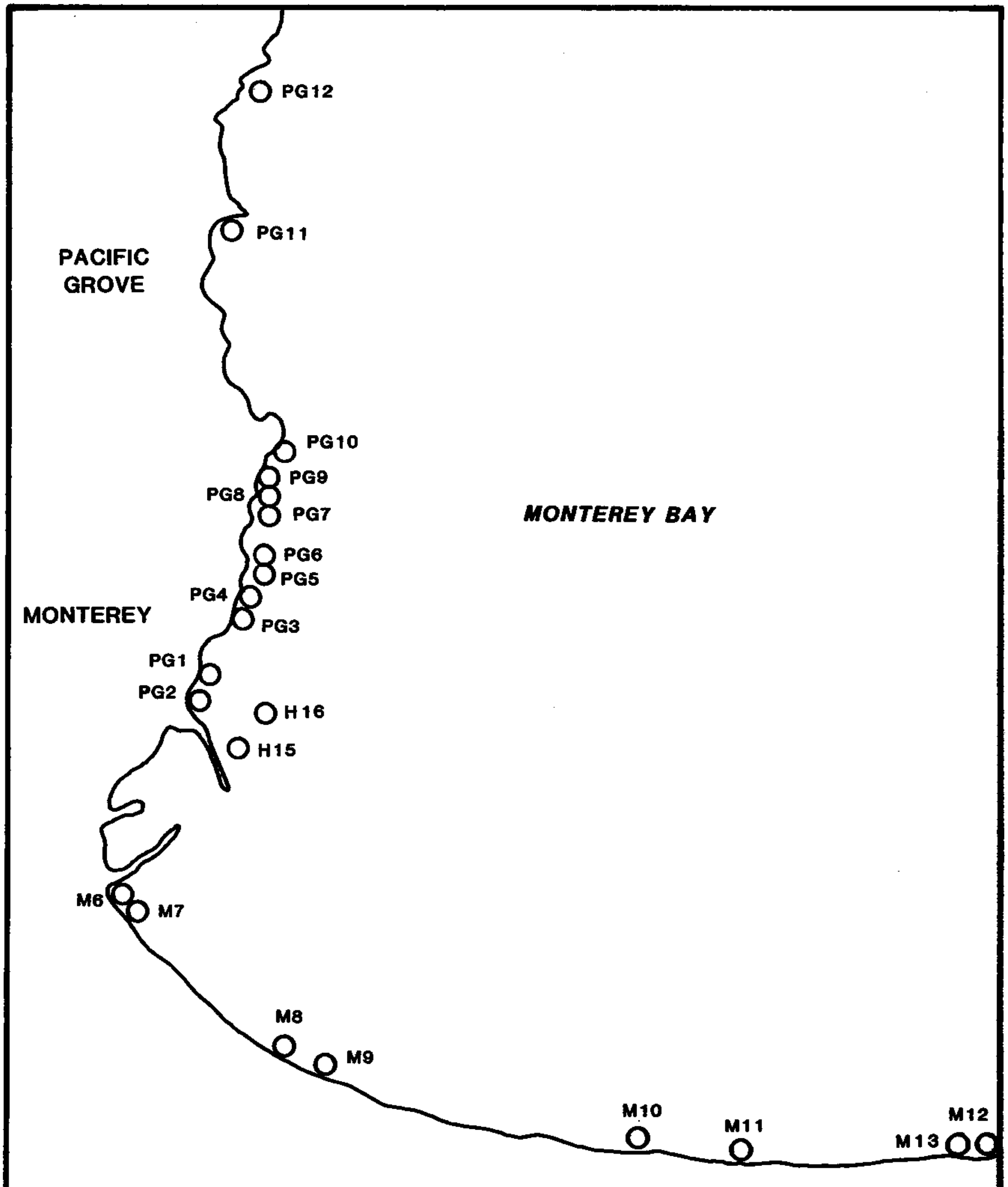

Figure 8. SEDIMENT SAMPLING SITES FOR LEAD IN MONTEREY BAY

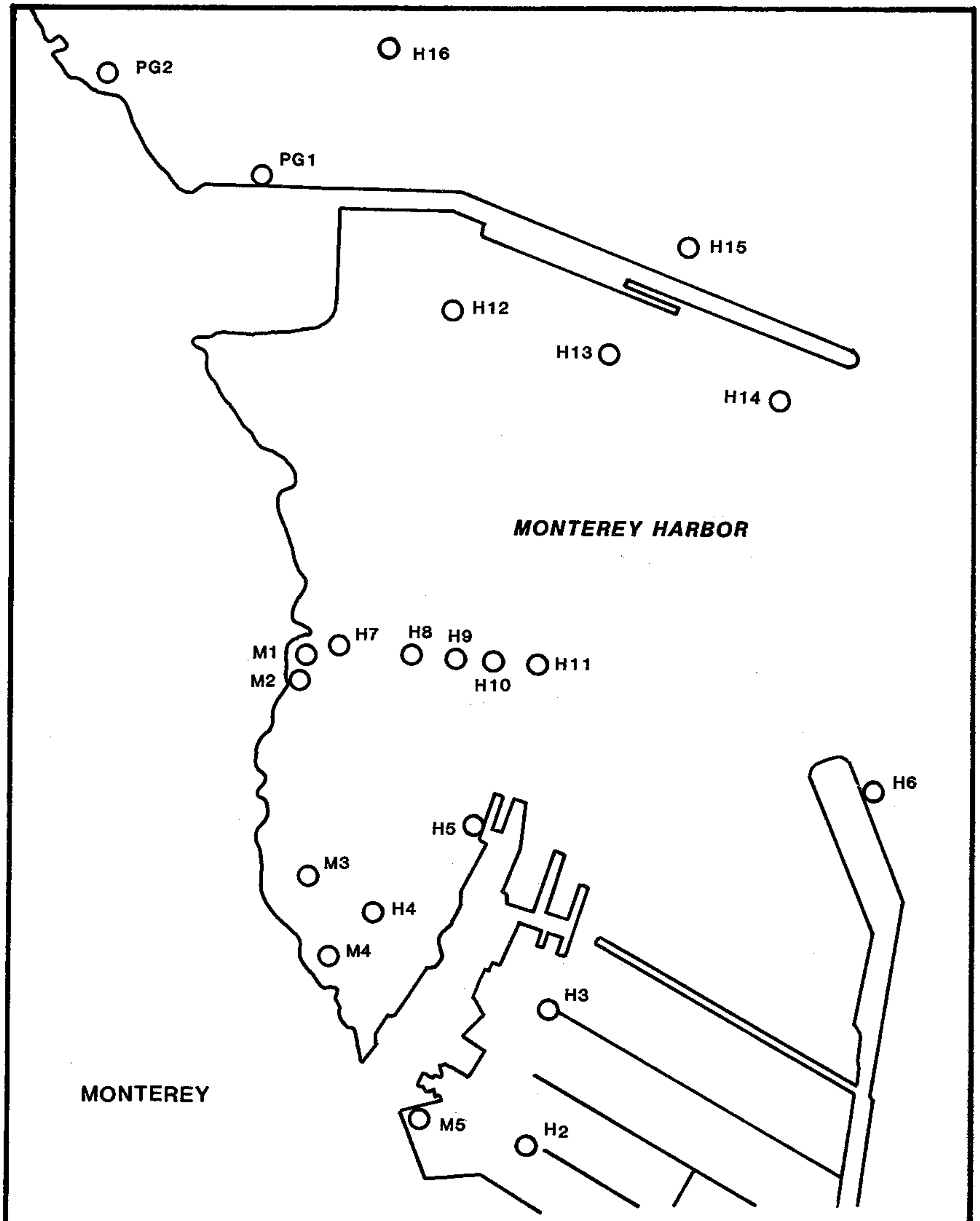

Figure 9. SEDIMENT SAMPLING SITES FOR LEAD IN MONTEREY HARBOR

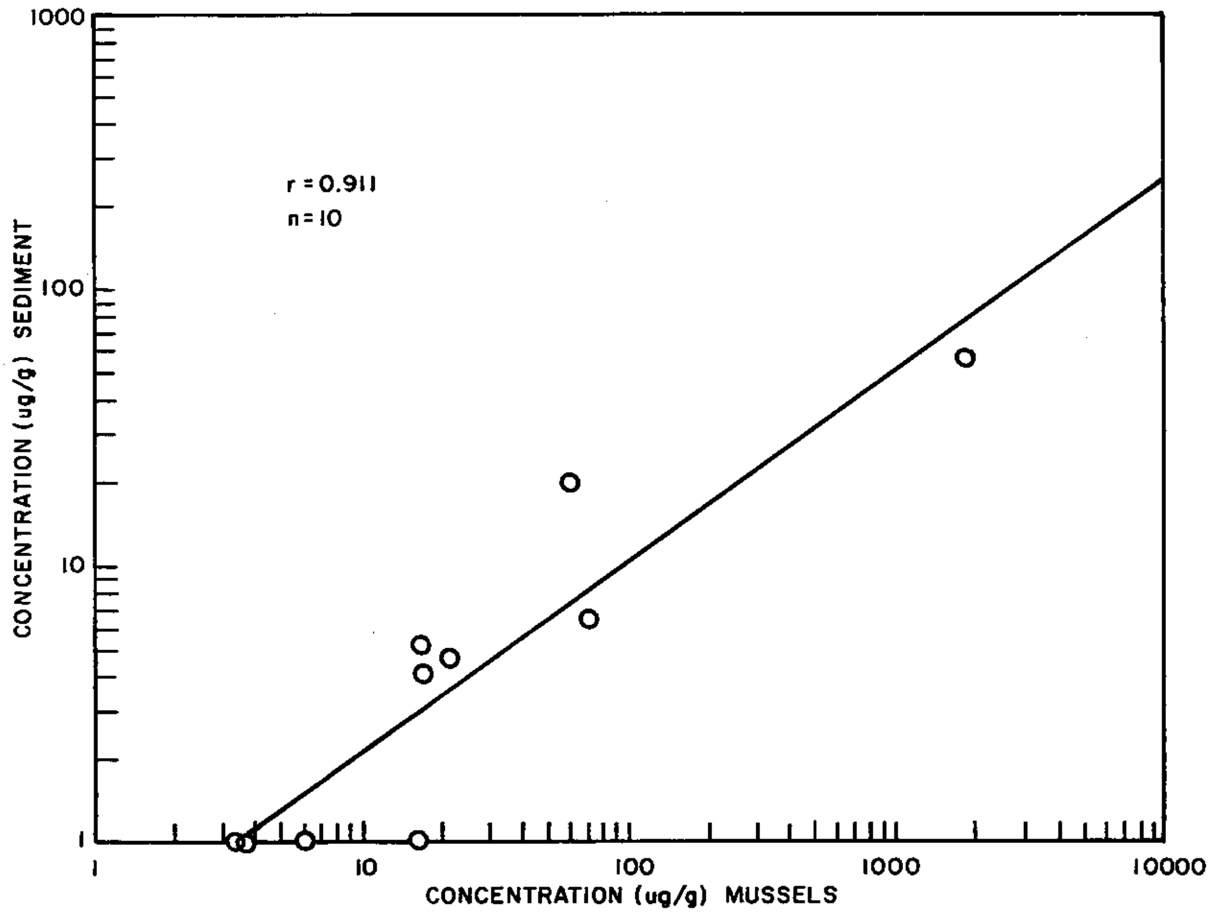

Figure 10. MONTEREY HARBOR CORRELATION OF LEAD IN MUSSELS AND SEDIMENT SAMPLES AT SAME LOCATIONS

3. Studies of lead concentrations in fin-fish will be undertaken.

4. Additional sediment samples will be taken in the Harbor and surrounding areas.

5. The Regional Board will survey the mainland area around Monterey Harbor to identify storm drains, historic dump sites, and other potential sources of lead inputs to the area.

Table 14. Monterey Area Lead Concentrations in Sediments

<u>HARBOR</u> (<u>H</u>)		<u>MONTEREY</u> (<u>M</u>)		<u>PACIFIC GROVE</u> (<u>PG</u>)	
Station	Concentration	Station	Concentration	Station	Concentration
H-1	52	M-1	7500	PG-1	12
H-2	33	M-2	7500	PG-2	7.6
H-3	19	M-3	77	PG-3	<5
H-4	17	M-4	20	PG-4	<5
H-5	55	M-5	21	PG-5	5.9
H-6	12	M-6	<5	PG-6	5.1
H-7	220	M-7	<5	PG-7	57
H-8	47	M-8	<5	PG-8	6.5
H-9	49	M-9	<5	PG-9	15
H-10	34	M-10	<5	PG-10	8.9
H-11	16	M-11	<5	PG-11	<5
H-12	24	M-12	<5	PG-12	<5
H-13	51	M-13	<5	PG-13	<5
H-14	24				
H-15	14				
H-16	<5				

3.3.7 CARMEL SANITARY DISTRICT SEWAGE TREATMENT PLANT OUTFALL SURVEY

Carmel Sanitary District discharges municipal effluent to Carmel Bay. The State Board has designated much of Carmel Bay as an Area of Special Biological Significance. The Regional Board and State Board have therefore required Carmel Sanitary District to monitor the effects of its discharge through use of State Mussel Watch monitoring techniques. In the 1983-84 sampling period, two monitoring techniques were used:

1. Transplanted mussels were placed at the stations shown on Figure 11, and later retrieved for analysis of trace metals and synthetic organic substances.

2. Scientists examined physiological health indicators of transplanted mussels from the same stations using a technique known as "scope for growth". This technique measures the net amount of energy available to mussels for growth and reproduction. Mussels subjected to stress from environmental

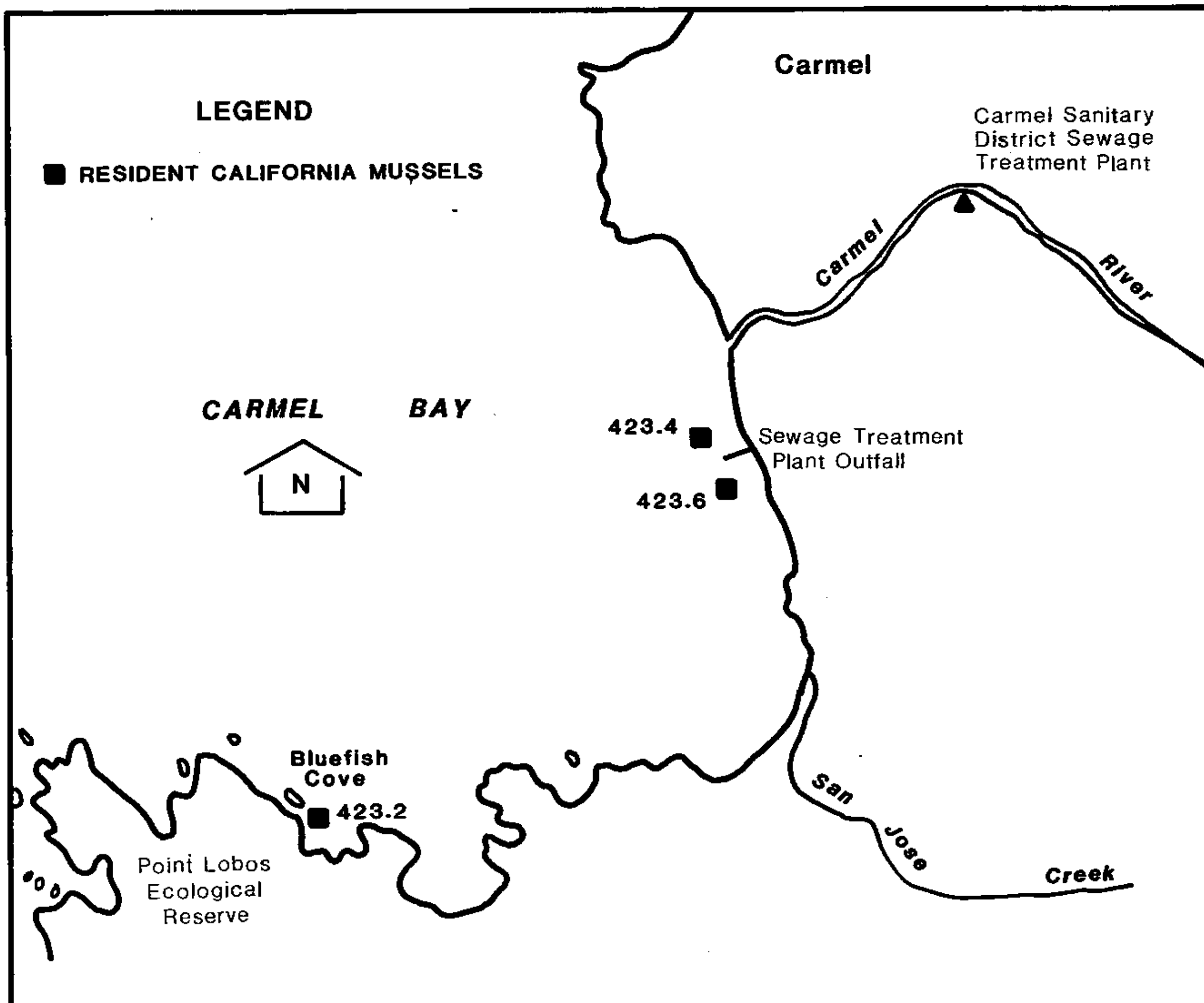

Figure 11. 1983-1984 SMW CARMEL BAY OUTFALL SURVEY

contamination will have less energy available for growth and reproduction, and hence will have a lower scope for growth than mussels not subjected to such stress. For example, mussels collected from environmentally clean areas near Bodega Head and Granite Canyon were found to have scope for growth index values of 28.7 and 29.9, respectively. Mussels taken from chemically influenced sites near Royal Palms and San Diego were found to have scope for growth values of 6.4 and 0.4, respectively. These values are reported as energy (measured in Joules) captured as body growth and gamete production per hour, normalized to a one-gram animal, as described by Martin et al. (1982).

Table 15 displays the trace metal and synthetic hydrocarbon concentrations found in the mussels transplanted from Carmel Bay. Silver and copper concentrations were higher at the outfall locations than at the control station. Cadmium and zinc concentrations were lower at the outfall stations than at the control station. Synthetic hydrocarbon concentrations were generally somewhat higher at the outfall stations than at the control station, but the differences were not statistically significant.

Table 15

Carmel Bay Trace Metal and Synthetic Organic Substance Concentrations, 1983-84

Measurement	Carmel Control Station (423.2)	Carmel Outfall South (423.6)	Carmel Outfall North (423.4)
Silver	0.608	1.125	1.768
Cadmium	7.4	4.4	5.3
Chromium	1.6	1.3	1.3
Copper	3.0	4.7	4.8
Mercury	0.320	0.204	0.211
Nickel	2.2	1.6	2.1
Lead	2.6	2.4	2.4
Zinc	152.9	116.4	122.3
Total Chlordane	7.3	11.1	9.0
Total DDT	26.0	42.4	33.6
Dieldrin	6.2	6.2	4.8
Endosulfan I	6.8	7.2	6.1
Alpha-HCH	5.8	8.1	6.6
Gamma-HCH	0.53	0.77	0.59
PCB 1254	28	39	29

Trace metals are reported as ug/g, dry weight.
Organics are reported as ng/g, dry weight.
All samples are transplanted California mussels.

The elevated silver concentrations at the outfall stations are particularly noteworthy. Results of statistical tests show that silver concentrations are significantly lower at the control station than at the northern outfall station ($p \leq 0.01$).

Furthermore, silver concentrations at both outfall stations are elevated compared to historical statewide concentrations of silver found in mussels transplanted by the State Mussel Watch program. Silver concentrations at the southern outfall station exceeded those found in 75% of the transplanted mussels sampled by the program, and silver concentrations at the northern outfall station exceeded those found in 90% of the transplanted mussels sampled by the program. These elevated silver concentrations should be further examined in future monitoring studies. As in the Crescent City outfall study, this may indicate a need to try to reduce silver input to the Carmel Sewerage System.

Table 16 contains the results of the scope for growth measurements. Statistically significant differences exist between normalized scope for growth measurements at the control station and the southern outfall station ($p<0.01$), and between the control station and the northern outfall station ($p<0.001$). While interpretation of physiological health measurement must be done with caution, these differences indicate that mussels near the outfall suffered significant declines in their physiological condition compared to mussels at the control station. Factors other than the discharge from Carmel Sanitary District cannot yet be ruled out as possible causes of the observed physiological results. Due to an unusually early rainy season in the fall of 1983, the Carmel River discharged into Carmel Bay for several months when the mussel transplants were deployed. The river discharge therefore may be a factor influencing the results of the Carmel Bay site specific study. However, the findings of physiological declines in mussels buoyed near the discharge indicate that additional scope for growth studies are necessary in Carmel Bay. Future monitoring efforts should be directed towards determining the cause of the lowered physiological conditions of mussels at the outfall stations, and determining the influence of the Carmel River on monitoring results.

Table 16. Carmel Bay Mussel Physiological Health Study

Measurement	Carmel Control Station (423.2)	Carmel Outfall South (423.6)	Carmel Outfall North (423.4)
Mean Length Mussels (mm)	65.7	62.7	60.4
Mean Weight (g dry)	0.97	1.41	1.31
Assimilation Efficiency (%)	82.7	89.1	46.0
Clearance Rate (l/h)	2.6	2.1	2.5
Oxygen Consumption (ml/h)	0.23	0.26	0.39
Ammonia Excretion (ug/h)	13.7	11.8	7.9
Scope for Growth (J/h) (one gram normal)	26.0	14.3	3.8

3.3.8 Diablo Canyon Powerplant Baseline Survey

Pacific Gas and Electric Company (PG&E) continued its contract with SMW to provide monitoring stations in the vicinity of the Company's Diablo Canyon Nuclear Power Plant. The purpose of this monitoring is to continue to provide information on baseline levels of trace metals and synthetic organic compounds prior to the actual operation of the plant. This work was performed pursuant to PG&E's NPDES permit (CA0003751) issued by the Central Coast Regional Water Quality Control Board. PG&E reimbursed the State Board for all costs of this work.

Figure 12 shows the general location of the study site, including stations north and south of the power plant. Figure 13 shows the locations of the five resident and five transplanted mussel stations established in the immediate vicinity of the power plant. SMW collected mussels at the resident mussel stations and collected mussels transplanted previously at the transplanted mussel stations on three occasions during the 1983-84 SMW monitoring year. All mussel samples were analyzed for nickel, arsenic, selenium and titanium as well as for the full scan of trace metals normally done by SMW. Of the synthetic organic substances, analysis was performed only for PCB 1248 and PCB 1254.

The trace metals copper, lead, silver, mercury and zinc, and the synthetic organic substances PCB 1248 and 1254 were chosen as indicators sensitive to the impact of natural and man made pollution for a variety of reasons. As described in Section 3.2.2 of this report, silver concentrations are often elevated near municipal wastewater discharges (Stephenson et al ., 1979, 1980, 1981). The use of copper, lead and zinc in their metallic forms or as metallic salts in a wide variety of industrial processes (described in Section 3.3.2) results in elevated levels of these metals being found near heavily industrialized regions. A quick review of the statewide SMW data for 1983-84, as shown in Table 4, indicates that the levels of these trace metals were elevated in the Los Angeles, Newport Bay, and San Diego Bay areas of Southern California. Mercury and PCBs are discussed because they frequently are found in elevated concentrations near rookeries of marine mammals and birds.

Silver levels throughout the Diablo Canyon area were relatively low, and never exceeded the 75% ETPLs for silver in resident and transplanted California mussels. The levels of silver in the vicinity of the power plant were either less than or in the same approximate range of silver levels measured by SMW in 1982-83. The highest silver level measured in resident and transplanted mussels from the power plant area was only 0.53 ug/g in resident mussels from the Intake Cove. The silver levels in the power plant area were within the range of values obtained from the control stations north and south of the powerplant. In fact, the highest silver value measured was at the Avila reference station (438.0). This was within the range of values found previously at that site and does not indicate silver pollution. The Avila station is, however, located within a few miles of a small municipal wastewater discharge, which may account for the slightly elevated silver value.

Copper levels in both resident and transplanted California mussels indicate that the waters in the Diablo Canyon area resemble those of clean areas of the California Coast. The maximum copper level recorded was 9.9 ug/g at the Avila control station (438.0), and this and lower copper levels within the Diablo Canyon area are within the range of values obtained for copper at the Coastal Reference Stations and other "clean" areas along the California coast. Copper levels were also similar to those measured in the Diablo Canyon area in 1982-83.

Measurements of lead in the Diablo Canyon survey area indicate that the waters of the area are cleaner than those of many areas along the California coast. The 75% ETPL of 5.9 ug/g for lead in resident California mussels was exceeded only once, at the North Diablo Cove station (433.0), where 10.9 ug/g was measured on April 23, 1984. The next highest value was 4.9 ug/g at Intake Cove (Station 435.0) and at Avila (Station 438.0). With the exception of the

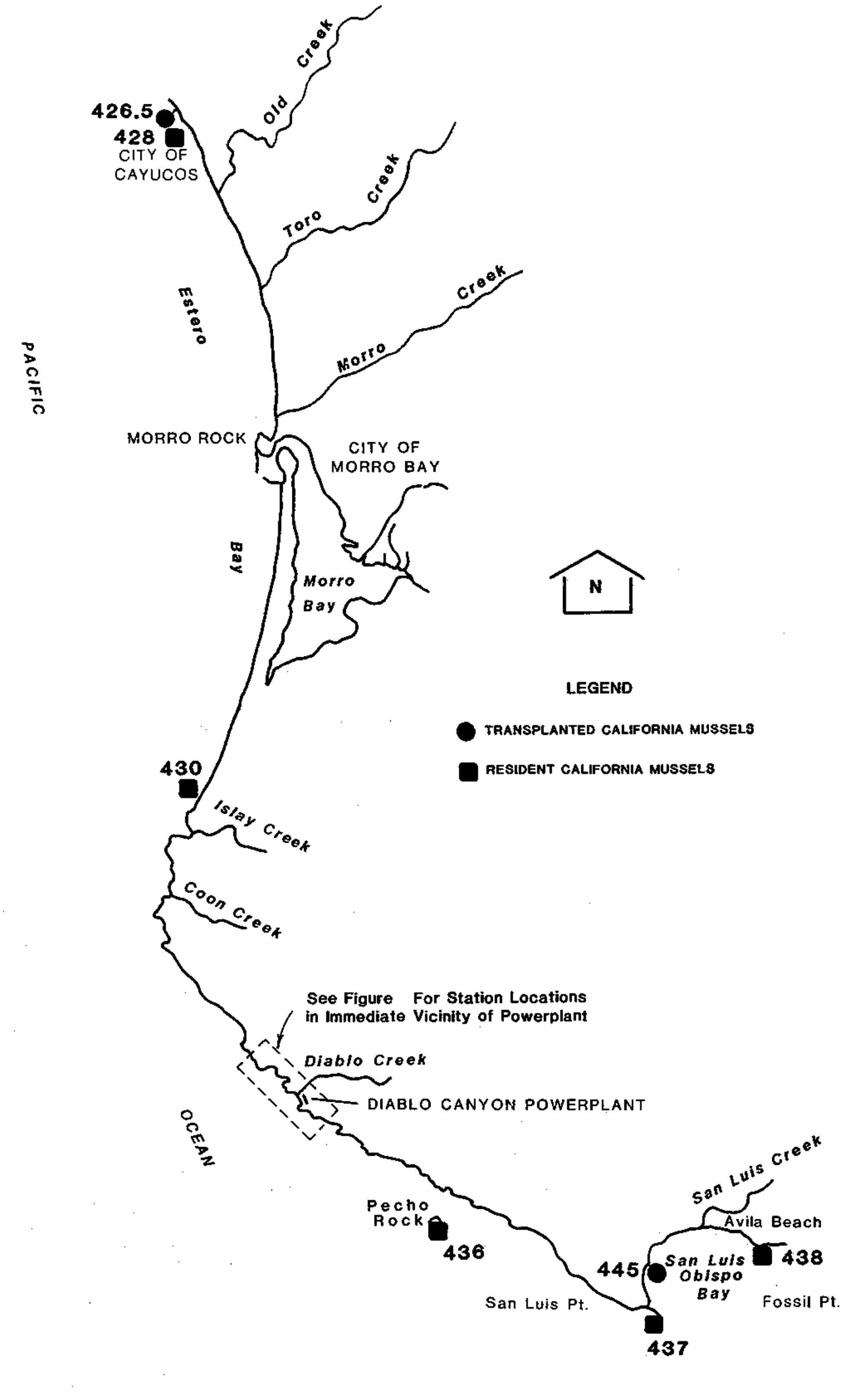

Figure 12. 1983-1984 SMW DIABLO CANYON POWERPLANT DISCHARGE SURVEY

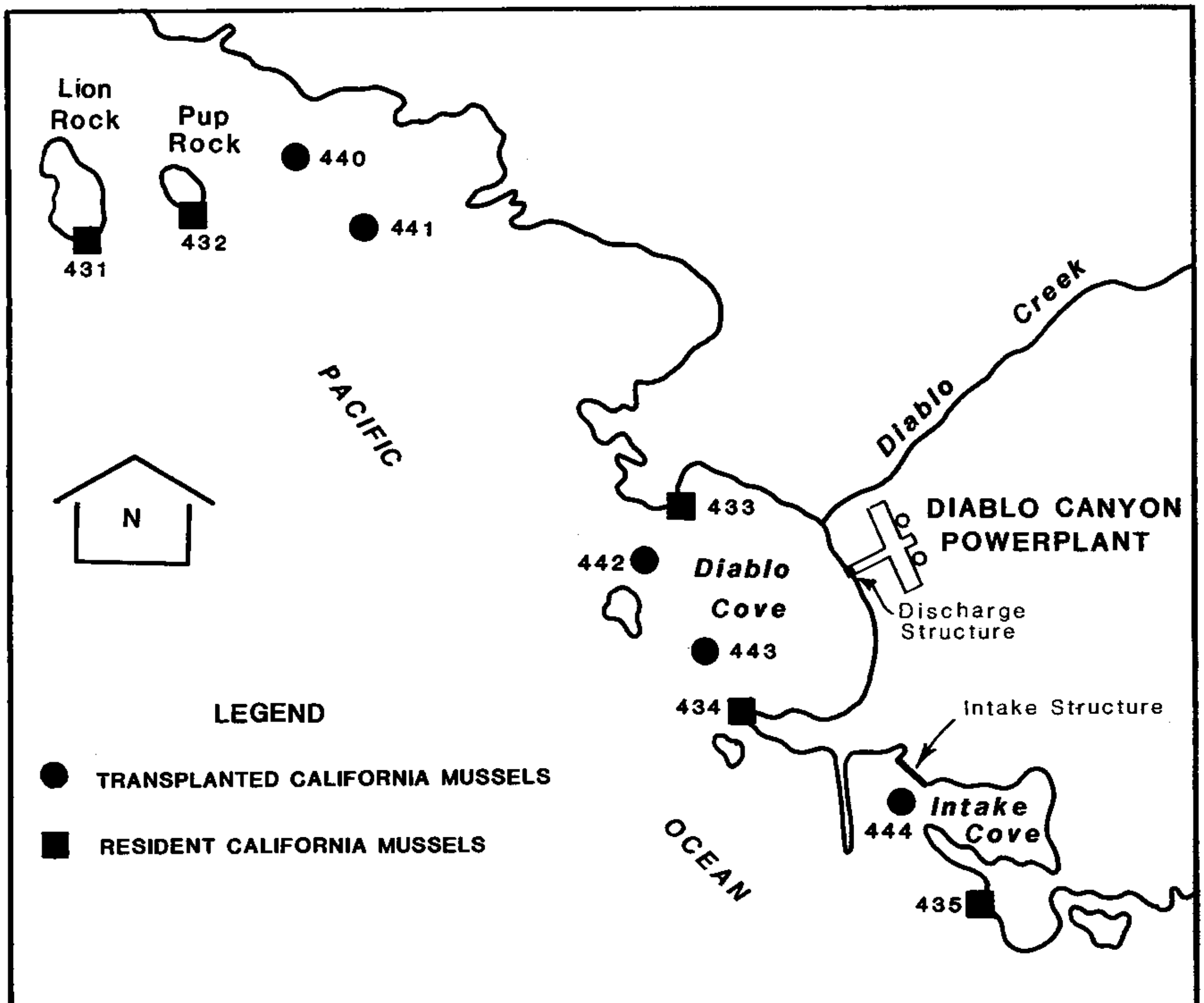

Figure 13. 1983-1984 SMW STATION LOCATIONS IN THE VICINITY OF THE DIABLO CANYON POWERPLANT

elevated value at the North Diablo Cove station, the remaining low resident. California mussel lead values are similar to those measured in 1982-83 and within the range of values found at coastal reference stations. The lead levels in transplanted California mussels in the Diablo Canyon survey area were all low, and did not approach the 75% ETPL for lead in transplanted California mussels. The lead levels measured in transplanted California mussels within the Diablo Canyon survey area are far less than those measured in the Southern California site specific surveys.

The levels of zinc in resident and transplanted California mussels in the Diablo Canyon survey area are elevated when compared to the Trinidad Head and Bodega Head Coastal Reference stations and the Crescent City and Humboldt Bay site-specific surveys in northern California where the baseline levels of zinc are naturally low. The 75% ETPL of 206.7 ug/g for zinc in resident California mussels was exceeded on one or more occasions at each of the ten SMW resident mussel stations. The 75% ETPL of 253.3 ug/g for zinc in transplanted California mussels was exceeded on five occasions at four of the seven SMW transplanted mussel stations. However, the maximum zinc level measured, 312.1 ug/g in resident mussels at the Intake Cove station, was within the range of values obtained at the coastal reference stations of central and southern California. These results indicate that the waters in the Diablo Canyon area are naturally high in zinc, but are not necessarily receiving zinc from urban or industrial development. Zinc levels at the transplant stations ranged from 146.9 ug/g at the Cayucos Pier reference station north of the plant site to 273.4 ug/g at the Intake Cove station (444.0) in the plant site vicinity. These levels area considerably less than those in Los Angeles/Long Beach Harbor where levels of over 400 ug/g were measured at three of seven stations.

Elevated mercury levels have been found to be associated with pinniped colonies (Flegal et al., 1981). The levels of mercury in resident Califonia mussels from the power plant area appear to support this finding. The mercury levels in resident mussels from the Pecho Rock station (436.0), at 0.94 ug/g and 0.74 ug/g, were the highest and third highest recorded by the 1983-84 SMW program, and exceeded the 90% mercury ETPL of 0.45 ug/g. A third 1983-84 SMW measurement at Pecho Rock of 0.35 ug/g exceeded the mercury 75% ETPL. The Pup Rock measurement of 0.63 ug/g exceeded the 90% ETPL. All of these rocky offshore sampling stations are inhabited by dense colonies of sea lions, and these pinnipeds appear to be contributing to the elevated mercury levels found there.

Mercury levels in both resident and transplanted mussels from the South Diablo Cove and Intake Cove stations (Stations 434.0 and 435.0) were elevated above the 75% ETPL for mercury in either resident or transplanted mussels during one of the three 1983-84 sample collection dates. The levels, however, were similar to the 0.36 ug/g of mercury measured in resident mussels at the Cayucos reference station on one occasion. In addition, the 1983-84 mercury levels appear to be in the same general range of concentrations as measured by SMW in 1981-82. Therefore, there does not appear to have been any increased input of mercury to the waters of the Diablo Canyon study area.

PCB 1248 and PCB 1254 levels in resident and transplanted mussels from the Diablo Canyon study area were also measured by SMW in 1983-84. Although restrictions on the use of PCBs in the United States began in 1979 and the

Toxic Substances Control Act of 1976 restricted PCB manufacture and commercial distribution in 1979 (EPA, 1980), the long unregulated history of use and subsequent disposal of PCBs have made this toxic, carcinogenic, and extremely persistent class of compounds one of the more ubiquitous toxic pollutants in terrestrial and aquatic environments. PCBs are slightly soluble in water, soluble in lipids, and resistant to biological degradation. PCBs can accumulate in aquatic organisms, and have been shown to bioaccumulate in fish up to 270,000 times the ambient concentration in water (EPA, 1980). The current U.S. Food and Drug Administration action level for declaring edible fish tissue unfit for human consumption is 2 ppm (ug/g) on a wet weight basis (USFDA, 1984).

PCB 1248 ($C_{12}H_6Cl_4$) was not detected at any of the Diablo Canyon survey area stations. This PCB isomer, used primarily in hydraulic fluids and plasticisers associated with aircraft construction, operation, and maintenance, was also not detected in 1982-83.

PCB 1254 was detected at extremely low levels (40.0 ng/g or less) at all resident and transplanted California mussel stations in the Diablo Canyon study area except for the San Luis Harbor station (445.0). There, successive collections of transplanted California mussels had PCB 1254 levels of 250.0 ng/g, and 74.0 ng/g during the 1983-84 SMW monitoring year. These levels are considerably below the 75% ETPL of 960 ng/g for PCB 1254, but indicate the possibility of local input of this PCB isomer to the area. PCB 1254 ($C_{12}H_5Cl_5$) has been used primarily as a dialectric fluid within transformers and capacitors (Ghirelli _et al_., 1983). The San Luis Harbor station experiences heavy boat usage, haul-out, and maintenance activity as well as other human activities that could contribute to the elevated PCB-1254 levels in the area. It appears that the San Luis Harbor station is not a good control station for PCBs as it also had elevated (111 ng/g) levels of PCB 1254 in 1982-83. However, monitoring should perhaps continue in the area to further isolate the PCB 1254 source or sources identified by SMW.

3.3.9 LOS ANGELES/LONG BEACH HARBOR DDT AND TRACE METALS SURVEY

The State Mussel Watch program has collected resident and transplanted mussel

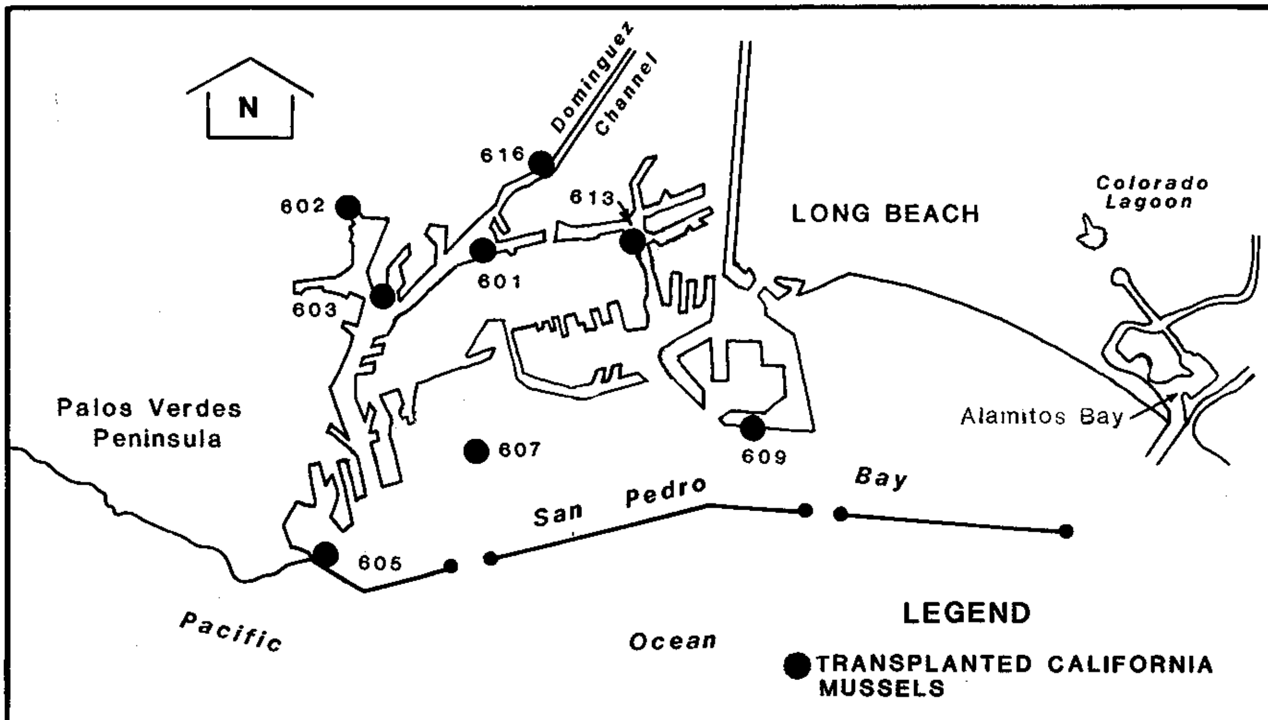

Figure 14.

1983-1984 SMW LOS ANGELES/LONG BEACH HARBOR SURVEY

The high concentrations of copper, lead, and zinc in samples taken from within Los Angeles/Long Beach Harbor are similar to results from previous surveys of the Harbor. In 1983-84, however, elevated chromium concentrations were more widespread than in previous years. Elevated chromium concentrations were found in six of the seven samples from the Harbor that were analyzed for trace metals in 1983-84. In addition, mercury was found in elevated concentrations at the National Steel station (601.0) and the Berth 151 station (603.0). Cadmium was also found in high concentrations at the National Steel station. Taken together with the results of earlier surveys, the 1983-84 results continue to show that mussels taken from inner areas of Los Angeles/Long Beach Harbor contain high concentrations of many toxic trace metals. Additional ground surveys of shipyards and other industrial facilities near the Harbor may help locate point sources of some of these trace metals. However, many of these trace metals have also been found in high concentrations in samples taken from outside the Harbor at the Royal Palms reference station (662.0). This indicates that additional point sources or non-point sources of trace metals may also exist in the area. Additional sampling will be necessary to help identify the major sources of trace metals in Los Angeles/Long Beach Harbor, and to help determine if the widespread elevated chromium concentrations found in the Harbor in 1983-84 are a long-term problem that also needs to be addressed.

Table 17. Metals in Los Angeles-Long Beach Harbor, 1983-84

Station Number	Station Name	Metals Exceeding ETPL 75	Metals Exceeding ETPL 90
601	National Steel	Cadmium, Copper, Mercury	Chromium, Lead, Zinc
602	West Basin		Chromium, Copper, Lead, Zinc
603	Berth 151	Chromium	Copper, Mercury, Lead, Zinc
605	Cabrillo Pier	Chromium, Copper	
607	Terminal Island	Chromium	
609	Tide Gauge		Lead
613	S. Cal. Edison	Chromium, Copper, Zinc	Lead
662	Royal Palms Reference*	Silver, Chromium, Copper, Lead	Zinc

*This station is located outside the Harbor. Resident California mussels were sampled at this station.

3.3.9.2 PCB and DDT in Los Angeles/Long Beach Harbor

As in previous years, PCB 1254 concentrations were high in mussels taken from inner Harbor areas. The ETPL 75 for PCB 1254 was exceeded at the National Steel station, the Berth 151 station, and the Consolidated Slip station (616). Unlike previous years, however, PCB 1248 was detected in the Harbor for the first time in 1983-84. The ETPL 90 for PCB 1248 was exceeded at the National Steel station and the Consolidated Slip station. The high concentration of PCB 1248 found at the National Steel station (460 ng/g or 60.3 ng/g wet weight) was the fourth highest concentration of PCB 1248 ever found by the SMW project. These results suggest that a source of PCB 1248 may exist in the vicinity of the National Steel and Consolidated Slip stations. As flows from the Dominguez Channel enter this area, it is also possible that the source of the identified PCB 1248 concentrations may be upstream of the Harbor in the area tributary to Dominguez Channel. Additional monitoring is needed to help locate the source of PCB 1248 in this area.

As shown in Table 17, DDT concentrations were also high in 1983-84. The ETPL 75 of 1158 ng/g for total DDT was equalled at the Berth 151 station and the Tide Gauge station. The ETPL 90 of 1931 ng/g total DDT was equalled at the National Steel station and exceeded at the Consolidated Slip station. The results are consistent with the findings of earlier surveys of the Harbor. These earlier surveys, taken together with the 1983-84 results, indicate that a continuing input of DDT and related compounds has been occurring in the Harbor. Based on the results of previous years, the Los Angeles Regional Water Quality Control Board and the U.S. EPA had issued Clean Up and Abatement Orders to Montrose Chemical Company in May 1983. Since the 1983-84 samples were collected in December 1983, only a limited time was available for the Clean Up and Abatement Orders to take effect before the SMW program samples were taken. It is therefore premature to judge the effects of the order. Table 18 lists the percentages of DDT and its breakdown products in the 1983-84 samples. These percentages indicate that recently mobilized DDT may have been present in the Harbor in late 1983 at the National Steel, Berth 151, and Consolidated Slip stations. Additional sampling will be necessary to determine if the input of DDT to the Harbor is reduced after the clean up efforts at the Montrose plant have had time to take effect.

Table 18. Percentages of DDT and Its Breakdown Products
Los Angeles/Long Beach Harbor, 1983-84

Station Name	Station Number	DDD (pp'and op')	DDE (pp' and op')	DDT (pp' and op')
National Steel	601	34%	50%	16%
Berth 151	603	33%	58%	9%
Cabrillo Pier	605	11%	88%	1%
Tide Gauge	609	10%	88%	2%
So. Cal Edison	613	19%	78%	3%
Consolidated Slip	616	40%	45%	15%

Similarly, total DDT concentrations in 1983-84 samples from the Harbor have in general <u>not</u> declined significantly from concentrations found in previous years. Table 19 lists the concentrations of total DDT found at stations where transplanted California mussels were sampled in both 1983-84 and previous years. The 1983-84 samples were not held in Harbor waters as long as samples from previous years. This would tend to cause reduced concentrations in 1983-84 samples compared to previous samples. Even without correcting for this difference in the samples, however, only the Tide Gauge station appears to have had significantly lower concentrations of total DDT in 1983-84 than in previous years.

Table 19

Trends in Total DDT in Mussels From Los Angeles/Long Beach Harbor, 1979-1984

Station Number	Station Name	Total DDT (ng/g dry weight) 1979-80	1980-81	1981-82	1983-84
601	National Steel			1358 (225)	1925 (252)
603	Berth 151			1111 (192)	1163 (150)
605	Cabrillo Pier			1032 (192)	875 (99)
609	Tide Gauge	2488 (386)	1529 (284)	1361 (267)	1158 (208)
613	So. Cal. Edison			1249 (224)	1014 (132)
616	Consolidated Slip			2460 (285)	2016 (200)

Wet weight values in ng/g are in parentheses
All samples are in transplanted California mussels

These continuing high concentrations of total DDT in the Harbor may be due to continued input of DDT from the Dominguez Channel and other sources, or may be the result of long-term persistence of DDT and its related compounds in the Harbor environment. Additional sampling will be necessary to determine if Harbor DDT concentrations decrease following Clean Up and Abatement efforts at the Montrose plant.

3.3.10 ANAHEIM BAY BASELINE SURVEY

Resident Bay mussels were sampled by SMW at three locations in Anaheim Bay during the 1981-82 monitoring year, and elevated levels of cis-chlordane, trans-chlordane, trans-nonachlor, pp' DDE, cadmium, lead, and aluminum were measured (Ladd et al., 1984). Anaheim Bay was not surveyed by SMW in 1982-83, but an expanded four station monitoring effort utilizing transplanted California mussels, was conducted by SMW in 1983-84. Figure 15 shows the location of the Anaheim Bay SMW stations. This effort was partially funded by the U. S. Naval Weapons Station at Seal Beach. The objective of the 1983-84 SMW monitoring effort was to further determine baseline levels for trace metals and synthetic organic substances within Anaheim Bay.

Levels of cadmium, manganese, lead, zinc, and mercury in transplanted California mussels each exceeded 75% or 90% ETPLs at one or more stations within the Bay. The Warner Avenue Bridge station (715.0) between Bolsa Bay and Huntington Harbour, and the Edinger Street Bridge station (713.0) on the Bolsa Chica Channel in the southeastern portion of the Bay had higher levels of cadmium, manganese, lead, zinc, and mercury than the remaining two stations near the mouth of Anaheim Bay. Of these two bridge stations, the Warner Avenue Bridge Station had higher levels of cadmium, manganese, lead, and zinc than the Edinger Street Bridge station. In fact, the manganese, lead and zinc measurements at these two stations all exceeded 90% ETPLs for these metals. The 33.8 ug/g of lead measured at the Warner Avenue Bridge far exceeded the 90% ETPL for lead of 9.2 ug/g, and was one of the highest lead measurements

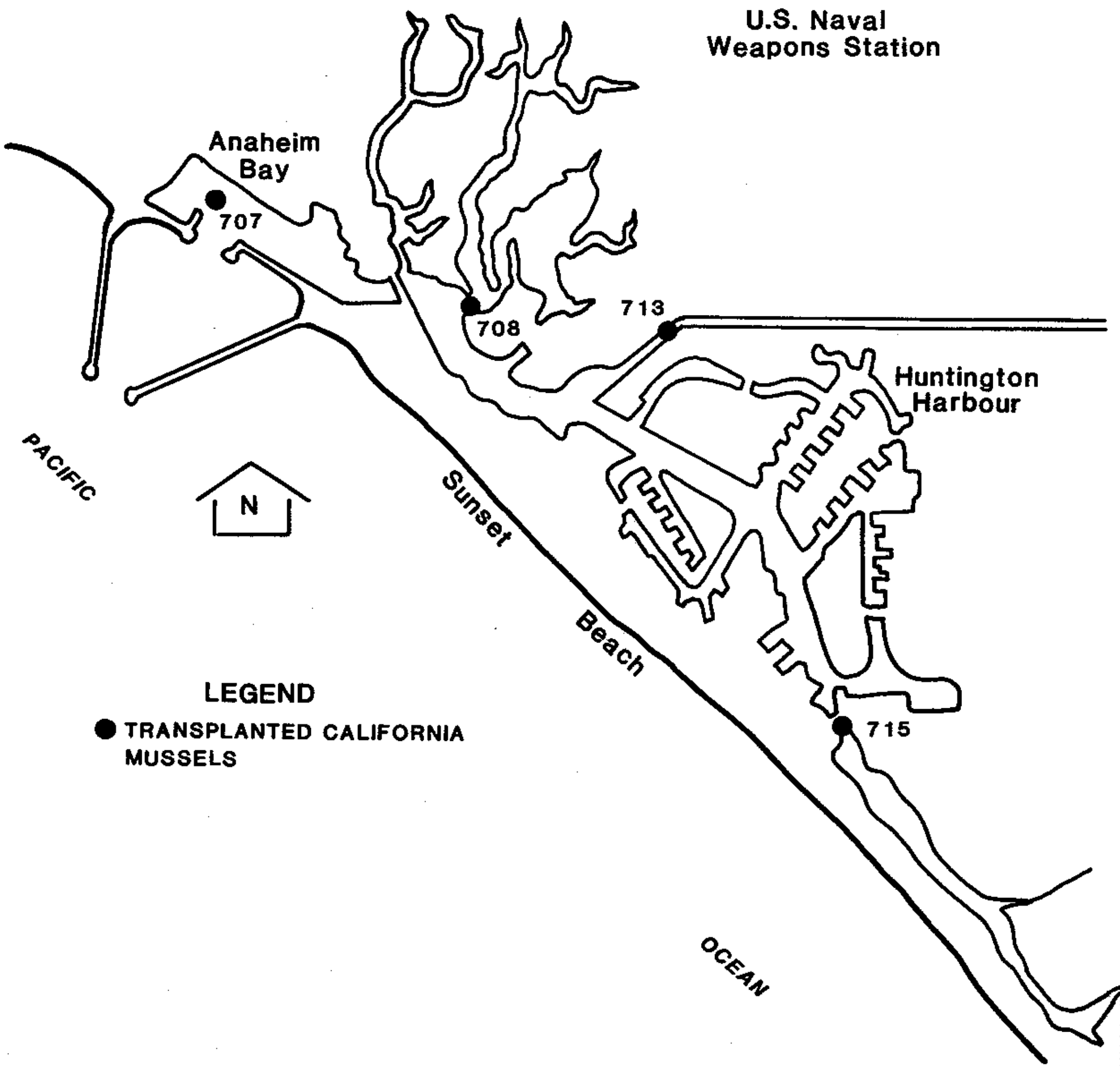

Figure 15. 1983- 1984 SMW ANAHEIM BAY SURVEY

obtained in 1983-84. The 84.7 ug/g of manganese measured at the Warner Avenue Bridge station also far exceeded the 90% ETPL of 35.8 ug/g and was the highest manganese level measured in 1983-84. The 44.6 ug/g of manganese at the Edinger Street Bridge station was also one of the highest manganese levels measured.

Transplanted California mussels from the Edinger Street Bridge station contained the highest levels of mercury recorded within Anaheim Bay and, at 0.48 ug/g, exceeded the 90% ETPL of 0.41 ug/g for mercury. Mussels from the Warner Avenue Bridge contained 0.39 ug/g of mercury which exceeded the 75% ETPL of 0.33 ug/g for mercury.

The uses of the trace metals just described are covered in some detail in Section 3.2.2 of this report. Anaheim Bay receives drainage from a large urbanized area that also includes industrial production and storage facilities that would permit entry of these metals and their salts to the Bay. Two major flood control channels, the Bolsa Chica Channel and the East Garden Grove-Wintersburg Channel, drain large nearby urban areas and flow into the southeastern portion of the Bay. The Warner Bridge station is located down channel from the mouth of the East Garden Grove-Wintersburg Channel and near two major oil field drilling and storage areas. In addition, this station is adjacent to the large Huntington Harbour on-the-water housing development. The Edinger Street Bridge Station is located on Bolsa Chica Channel. The input from urban drainage and industrial development within the southeastern portion of Anaheim Bay, coupled with the reduced flushing away from the Anaheim Bay mouth, appears to have contributed to the elevated levels of most of the trace metals in this portion of Anaheim Bay.

Anaheim Bay shows elevated levels of a wide range of synthetic organic substances, with the highest levels almost always occurring in the southeastern portion of the Bay where the Edinger Street Bridge and Warner Avenue Bridge stations are located. Briefly, the levels of the following synthetic organic substances in transplanted California mussels exceeded ETPLs at one or more Anaheim Bay stations: total chlordane and various chlordane components, total DDT and various degradation products of DDT, chlorpyrifos, dacthal, endosulfan I, gamma-HCH, heptachlor epoxide and toxaphene. Table 20 shows which substances exceeded ETPLs at each station. The actual values measured by the 1983-84 SMW program are tabulated in Table 4 and in Appendix B of this report.

The parallel between the SMW synthetic organic substances measurements and the trace metal measurements is striking. For <u>every</u> synthetic organic substance measured, except op'-DDE, the levels were <u>higher</u> at the "bridge" stations in the southeastern portion of the Bay than they were at the Navy Harbor and Navy Marsh stations near the mouth of the Bay. The consistency of this finding indicates that significant input of synthetic organic substances is occurring within the drainage area of Anaheim Bay.

The input of synthetic organic substances may indeed be occurring at high levels throughout the Bay, and the differences between stations may be due to differences in water circulation patterns. As mentioned briefly before, the Navy Harbor and Navy Marsh stations are located near the mouth of Anaheim Bay and are subject to greater water circulation than the "bridge" stations in the southeastern portion of the Bay. In spite of this possibility, the levels of many synthetic organic substances exceeded ETPLs at all four stations, and expanded SMW monitoring in Anaheim Bay is definitely recommended beginning in 1985.

Table 20. Synthetic Organic Substances exceeding ETPLs in Anaheim Bay, 1983-84

Station Number	Station Name	Substances Exceeding ETPL 75	Substances Exeeding ETPL 90
707	Navy Harbor	gamma-HCH, heptachor epoxide	chlorbenside
708	Navy Marsh	heptachlor epoxide	chlorbenside, gamma-HCH
713	Edinger Street Bridge	dacthal, total DDT, dieldrin, total chlordane	chlorpyrifos, gamma-HCH, heptachlor epoxide, toxaphene
715	Warner Avenue Bridge	dacthal, total DDT, dieldrin, endosulfan I, toxaphene, total chlordane	chlorpyrifos, gamma-HCH, heptachlor epoxide

A review of the SMW data for Anaheim Bay makes it difficult to ignore the possibility that a significant input of synthetic organic substances is occurring in the southeastern portion of Anaheim Bay. Most probably, the input is from the drainage areas of the Bolsa Chica and East Garden Grove-Wintersburg flood control channels as well as from oil field and housing/industrial developments which are contiguous to this portion of the Bay.

The 1983-84 total chlordane measurement was 262.8 ng/g (18.4 ng/g wet weight) at the Warner Avenue Bridge station and 153.7 ng/g (13.2 ng/g wet weight) at the Edinger Street Bridge station. Both of these measurements far exceeded the 75% ETPL of 85.8 ng/g for total chlordane. A possible source of chlordane input to Anaheim Bay could be its use in pest control in urban areas.

Chlordane is a persistent, toxic, polycyclic chlorinated hydrocarbon pesticide that has been used extensively for over 30 years for termite control, for soil insect control during farm crop production, and as an insecticide for homes and gardens (EPA, 1980). In 1975, EPA issued a registration suspension notice for all food, crop, and home and garden uses of chlordane. A total of 128,230 pounds of chlordane were used in California in 1983 for pest control purposes only (CDFA, 1983). The predominant usage within this category is termite control.

The total DDT measurement at the Warner Avenue Bridge station was 1695.8 ng/g (118.7 ng/g wet weight), while it was 1188.8 ng/g (102.2 ng/g wet weight) at the Edinger Street Bridge Station. Both of these measurements exceeded the 75% ETPL of 1158 ng/g for total DDT. Although DDT has been banned since 1972, DDT and its metabolic degradation products continue to be present at elevated levels in areas receiving runoff from urban and agricultural areas because of the persistence of DDT and its ability to be dispersed widely within the terrestrial and aquatic environments through erosion, runoff, and volatilization.

The DDT distribution just described within the Anaheim Bay drainage area is undoubtedly in response to the same mechanisms that have operated to produce the characteristically elevated levels of trace metals and other synthetic organic substances in the southeastern portion of the Bay. It is noteworthy that high levels of DDT have been found in the Newport Bay drainage a few miles south of Anaheim Bay. This indicates that DDT pollution may be widespread in the Orange County coastal plain drainages.

The distribution of toxaphene within Anaheim Bay provides a striking comparison between the less polluted region of the Bay near its mouth and the more polluted southeastern region of the Bay. Toxaphene was not detected at the Navy Harbor and Navy Marsh stations located near the mouth of the Bay, but was detected in the southeastern portion of the Bay at levels that exceeded 75% and 90% ETPLs for the pesticide. The Edinger Street Bridge station mussels had 270 ng/g of toxaphene present, which just exceeded the 90% ETPL of 260 ng/g for toxaphene, and the Warner Avenue Bridge station mussels had 220 ng/g of toxaphene present, which exceeded the 75% ETPL of 60 ng/g for toxaphene. The characteristics and usage patterns of toxaphene are discussed in some detail in Section 3.3.5 and will not be amplified here. The pattern of distribution of toxaphene within the Bay is a dramatic example of the characteristic distribution pattern of almost all of the organic substances and most of the trace metals within the Bay. Further SMW monitoring of Anaheim Bay is indicated because of this pattern. Use of freshwater clams in the Bolsa Chica

Metals	Organics
Mercury	Gamma-HCH
Lead	Heptachlor Epoxide
Zinc	Toxaphene
Copper	PCB 1254
Cadmium	PCB 1248
	Total Chlordane
	Total DDT

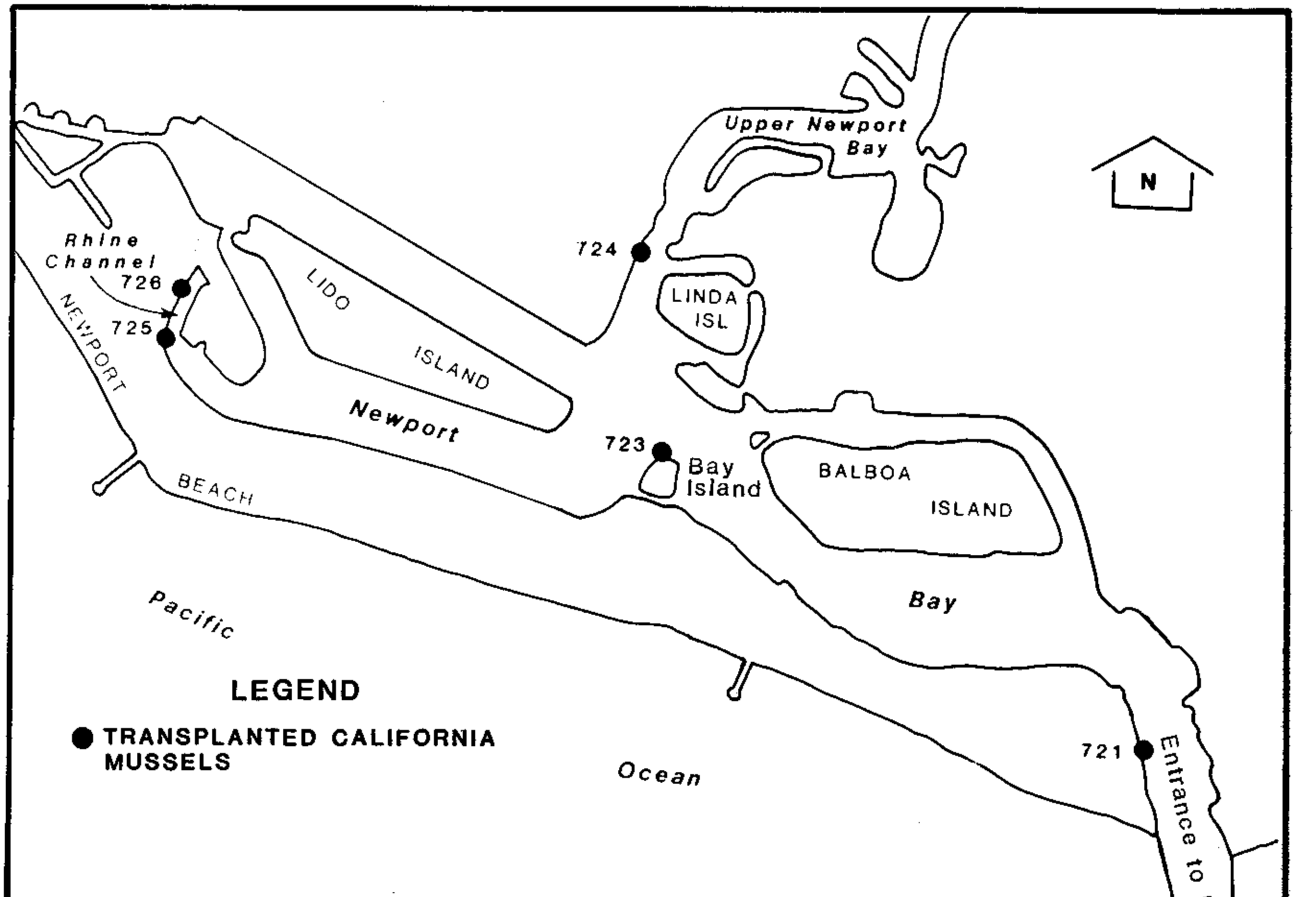

Figure 16. 1983-1984 SMW NEWPORT BAY SURVEY

More specifically, metal concentrations were particularly high at the Upper Rhine Channel station (726.0), where levels exceeded the ETPL 90 for lead, mercury, zinc and copper, and where levels exceeded the ETPL 75 for cadmium. Samples from the Crows Nest station (725.0) exceeded the ETPL 90 for lead, mercury, zinc, and copper. Samples from the Pacific Coast Highway Bridge station (724.0) exceeded the ETPL 90 for zinc and cadmium and the ETPL 75 for lead. Samples from the Newport Bay Entrance station (721.0) exceeded the ETPL 90 for lead, and the ETPL 75 for mercury and zinc. The Bay Island station (723.0) was not analyzed for metals in 1983-84, but samples from all four stations that were analyzed contained elevated concentrations of at least three different metals.

Table 21. Toxic Substances in Transplanted California Mussels from Newport Bay, 1983-84

Substance	Entrance 721.0		Bay Island 723.0		Hwy 1 Bridge 724.0		Crows Nest 725.0		Upper Rhine Channel 726.0	
Silver	0.12	(0.01)	N		0.09	(0.01)	0.17	(0.02)	0.10	(0.01)
Aluminum	644.3	(73.4)	N		421.1	(45.9)	455.2	(55.5)	502.8	(59.3)
Cadmium	10.2	(1.2)	N		12.6	(1.4)	8.4	(1.0)	11.3	(1.3)
Chromium	2.4	(0.3)	N		2.5	(0.3)	1.9	(0.2)	2.1	(0.2)
Copper	10.1	(1.2)	N		7.6	(0.8)	38.3	(4.7)	61.8	(7.3)
Mercury	0.35	(0.04)	N		0.33	(0.04)	0.53	(0.06)	0.60	(0.07)
Manganese	20.8	(2.4)	N		20.9	(4.3)	35.4	(4.3)	50.7	(6.0)
Lead	11.9	(1.4)	N		7.3	(2.2)	17.8	(2.2)	26.6	(3.1)
Zinc	272.9	(31.1)	N		365.6	(39.8)	408.0	(49.8)	533.5	(63.0)
Total DDT	1370.2	(152.1)	4377.7	(599.7)	3832.8	(379.4)	1911	(202.6)	1577.6	(183.0)
Total chlordane	123.6	(13.7)	478.7	(65.6)	348.5	(34.5)	322	(34.1)	289.5	(33.6)
PCB 1254	260	(28.9)	710	(97.3)	450	(44.6)	2600	(275.6)	2700	(313.2)
PCB 1248	D		D		D		460	(48.8)	280	(32.5)
Toxaphene	N		N		880	(87.1)	480	(50.9)	N	
Gamma-HCH	N		N		4.0	(0.4)	2.8	(0.3)	N	
Heptachlor epoxide	N		N		3.0	(0.3)	3.9	(0.4)	N	

Metals are reported as ug/g (dry weight); organics as ng/g (dry weight)
N=Not Analyzed; D=Not Detected
Wet weight values in ng/g are in parentheses

All five stations were analyzed for organic compounds in 1983-84. Samples from the Pacific Coast Highway Bridge station and the Bay Island station had the two highest concentrations of total DDT ever found in California mussels by the State Mussel Watch program. Samples from the Pacific Coast Highway Bridge station also exceeded the ETPL 75 for gamma-HCH and heptachlor epoxide, and samples from the Crows Nest station exceeded the ETPL 90 for heptachlor epoxide. Samples from both the Crows Nest station and the Upper Rhine Channel station exceeded the ETPL 90 for PCB 1254 and PCB 1248. Toxaphene was present at both the Pacific Coast Highway Bridge station and the Crows Nest station at concentrations that exceeded the ETPL 90. Total chlordane exceeded the ETPL 75 at the Newport Bay Entrance station, and exceeded the ETPL 90 at each of the other four stations. The total chlordane concentrations at the Bay Island and Pacific Coast Highway bridge stations were among the highest ever detected in mussels by the State Mussel Watch program.

In assessing these results, it is interesting to note that, in 1983, the Toxic Substances Monitoring Program (TSM) sampled fresh waters tributary to Newport Bay for the first time. Whole body concentrations of toxic pollutants were analyzed in red shiners taken from San Diego Creek, which flows into Upper Newport Bay. One must be very careful when interpreting these fresh water results, as whole body fish samples tend to contain higher concentrations of pollutants than the filet samples normally analyzed by the TSM program.

Nevertheless, compared to other fresh samples taken in fresh water, the red shiner samples contained high concentrations of chromium, lead, zinc, chlorpyrifos, dacthal, endosulfan, total chlordane, toxaphene, PCB 1254, and DDT and its breakdown products. The toxaphene and DDT levels found in red shiners from San Diego Creek were the highest measured among all whole body analyses conducted by the TSM to date (Agee *et al*., 1985).

As lead, zinc, total chlordane, toxaphene, PCB 1254, and the DDT related compounds are all also found in high concentrations in mussels taken from the marine waters of Newport Bay, it is possible that San Diego Creek is a significant source of these pollutants in Newport Bay. Additional monitoring to evaluate this possibility, and to help pinpoint other potential sources of the many toxic pollutants found in Newport Bay, is being conducted by the Regional Board

3.3.12 MISSION BAY BASELINE SURVEY

The objective of SMW in Mission Bay in 1983-84 was to determine baseline levels of trace metals and synthetic organic substances. Mission Bay, immediately north of San Diego Bay, has never been comprehensively sampled in the history of the SMW program. Bay mussels from Mission Bay were first sampled by SMW at a single station in 1979-80 for trace metals and organic substances in conjunction with the monitoring effort in San Diego Bay. SMW monitoring continued in Mission Bay in 1980-81 with two Bay Mussel stations monitored for trace metals and a single Bay mussel station monitored for synthetic organic substances including PCBs. PCB and trace metal levels in Mission Bay were found to be considerably less than those in San Diego Bay during the 1979-81 SMW monitoring period. PCBs were monitored in Bay mussels at one Mission Bay station by SMW in 1981-82. During this monitoring year, trace metals were monitored by SMW in resident Bay and California mussels at six Mission Bay stations. Although the results of the Mission Bay monitoring were not always directly comparable to the 1981-82 San Diego Bay monitoring results using transplanted California mussels, the PCB and trace metal levels within Mission Bay were usually considerably less than those measured in San Diego Bay.

Mission Bay is a major water contact recreation area with extensive facilities for swimming and boating. Use of the Bay is extensive because the Bay is located in the urban San Diego area and is a convention site. The Bay receives runoff from the surrounding urban areas as well as seasonal flows from the more rural canyon and mesa areas draining into the Bay. Rose Creek enters in the northeast corner of the Bay and drains a large area including Rose Canyon, San Clemente Canyon, and the Miramar Naval Air Station. In addition, storm drains have been laid along the bed of Rose Creek. When the drains overflow, there is input of sewage into Rose Creek and subsequently into Mission Bay. The Tecolate Canyon area drains into the southeastern portion of the bay through Tecolate Creek. Finally, the San Diego River flows into the Pacific Ocean south of the Bay mouth after collecting runoff from Murray Canyon and urban areas to the east.

An additional source of input of pollutants to Mission Bay is the old Mission Bay Landfill site that makes up a large portion of the southern land border of the Bay. This landfill was in operation for approximately 8 years and was closed by 1960. Because the impact of this closed landfill area on the biota of the Bay has not been evaluated, six of the nine SMW stations were located along the southern shore of the Bay as shown on Figure 17.

Because of the extensive boating activities within Mission Bay, one would expect levels of trace metals used in marine anti-fouling paints to be high in the California mussels transplanted there. This is in fact what has been found. Marine anti-fouling paints have used aluminum, cadmium, copper, lead, and zinc as a metallic base to protect boat hulls and wooden and metallic structures such as marina wharfs, pilings, etc, that are exposed to the corrosive effects of sea water. Within the Bay, elevated levels of aluminum, cadmium, lead and zinc were found at three or more of the seven SMW trace metal monitoring stations. Lower levels of these trace metals had been found by SMW in resident Bay mussels from Mission Bay in 1981-82. The aluminum levels in transplanted California mussels from four of the seven Mission Bay stations exceeded the aluminum ETPL 90 of 803.0 ug/g, with the Fisherman's Channel station (866.0) having the fourth highest aluminum level measured statewide by the SMW program in 1983-84, and the Hilton Docks station (865.0) having the sixth highest aluminum level measured statewide by the SMW program. These stations are in the central and eastern portions of the Bay where major marina activities are located. In addition, water mixing is less in the eastern portion of the Bay which is farthest from the Bay mouth. The Harbor Police station (873.0) and San Diego River Channel station (874.0) near the mouth of the Bay, where tidal circulation is greatest, had the lowest aluminum levels within the Bay. Finally, the Rose Creek drainage into Mission Bay includes flows from major urban and rural areas including a large military installation, a sewage system, and industrial development. It is indeed possible that elevated levels of trace metals could be flowing into northern Mission Bay from Rose Creek and into eastern Mission Bay from Tecolate Creek. In summary, elevated aluminum levels in transplanted mussels have been measured in the central and eastern portions of Mission Bay, and these levels appear to be subject to water mixing patterns and flushing due to tidal changes.

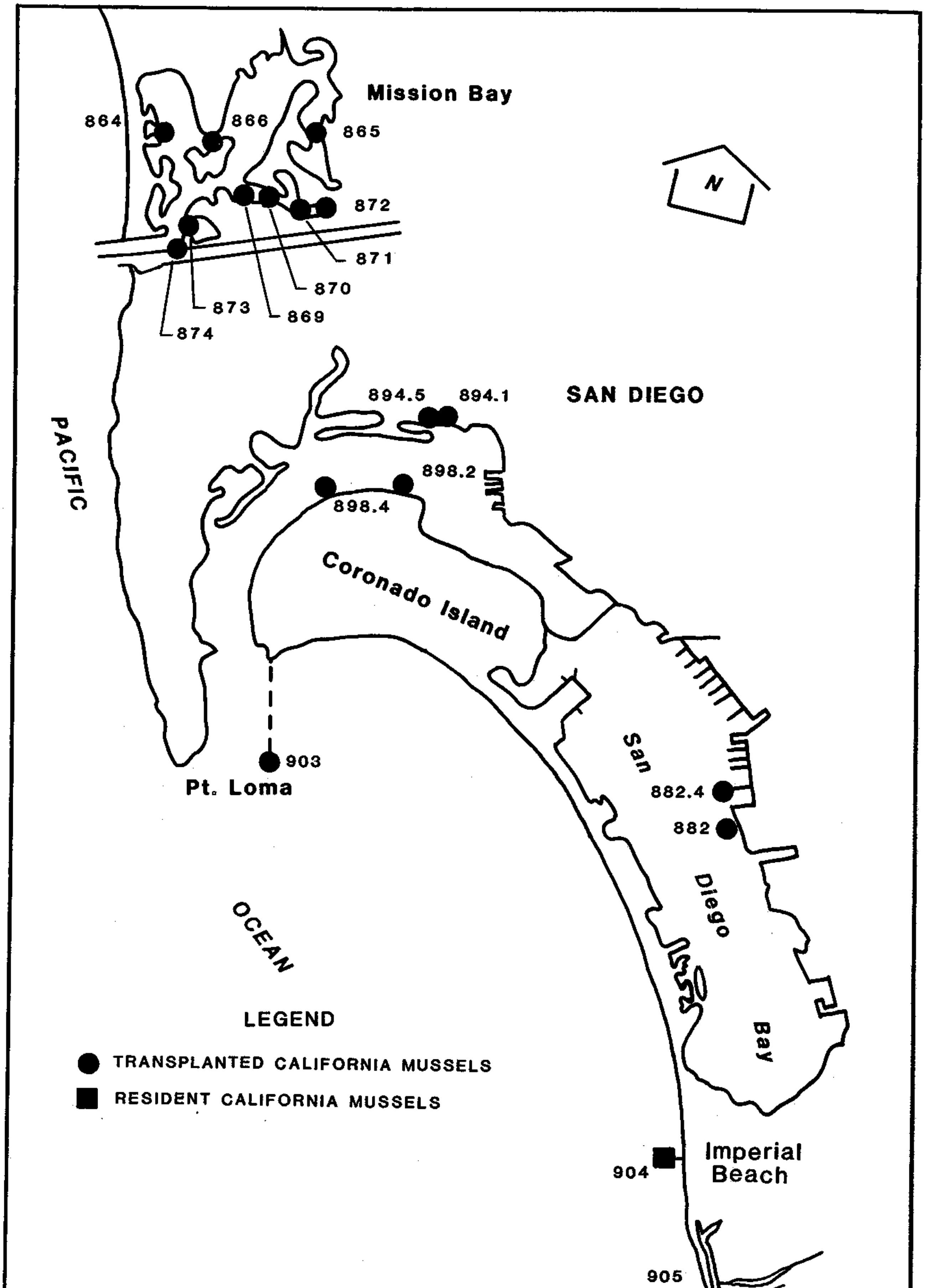

Figure 17. 1983-1984 SMW MISSION BAY AND SAN DIEGO BAY SURVEYS

The Mission Bay aluminum results, although suggestive of aluminum "hot spots" within the Bay, must still be interpreted with caution. The highest 1983-84 SMW aluminum value of 1578.6 ug/g was measured in resident California mussels at the nearby Oceanside Coastal Reference station (750.0). The same factors causing elevated aluminum levels in Mission Bay may be operating in the Oceanside area. It is also possible that some additional source of aluminum exists in the coastal San Diego area causing elevated baseline levels of aluminum.

The levels of lead and cadmium followed the same general pattern as aluminum. The Hilton Docks station located in eastern Mission Bay and the Fisherman Channel station located in central Mission Bay both had elevated levels of lead and cadmium. Of the four trace metal stations with lead levels that exceeded the ETPL 75 of 5.7 ug/g for lead, these two Bay stations had the highest levels. The Harbor Police Station the southern shore of the Bay was the only other trace metal station with cadmium levels that exceeded the ETPL 75 of 10.6 ug/g for cadmium. Presumably, the forces operating to produce the elevated aluminum levels within the Bay have also operated to produce the similar levels of lead and cadmium.

Resident California mussels from the nearby Oceanside coastal reference station had low levels of lead and cadmium. The 1.2 ug/g of lead and 3.1 ug/g of cadmium measured were considerably below the lead and cadmium levels found in Mission Bay. The Oceanside results appear to indicate that the elevated levels of lead and cadmium in Mission Bay are due to sources unique to the Bay drainage.

Zinc levels exceeding the ETPL 75 of 253.3 ug/g occurred at the Fisherman's Channel station, the Sea World Tower station (869.0), and the Harbor Police station. The 357.9 ug/g of zinc measured at the Harbor Police station exceeded the ETPL 90 of 332.2 ug/g. This station is located at the mouth of the Quivera Basin which is an area of extensive boating activity. The Sea World station is located in Perez Cove at the junction of the Mission Bay Channel and the Pacific Passage, two major Bay boatways, and is thus exposed to considerable boating activity. The boating activity and input from the drainages to Mission Bay appear to be the major sources of zinc input to the Bay.

Mission Bay had low levels of many synthetic organic substances within its waters. The levels of PCB 1254 at the five SMW California mussel transplant stations ranged from 140 ng/g to 380 ng/g which was considerably less than the ETPL 75 of 960 ng/g. PCB 1254 levels in Newport Bay to the north and nearby San Diego Bay to the south are 8 to 40 times higher than the Mission Bay levels. The total chlordane measurement of 195.3 ng/g at the Hilton Docks station in the eastern portion of the Bay and 156.5 ng/g at the San Diego River Channel station (874.0) in the southern portion of the Bay exceeded the total chlordane ETPL 75 of 85.8 ng/g. Chlordane is presently being used for pest control purposes only, with termite control being the predominant usage. The Hilton Docks station is between the inflows of Rose Creek and Tecolate Creek and the large areas they drain. The San Diego River station, of course, receives input from the large urban area to the east drained by the San Diego River. It is possible that runoff from pest (termite) control activities within these drainages could account for the elevated chlordane levels at these Mission Bay stations.

Other synthetic organic substances that are presently used for termite control are aldrin and dieldrin through subsurface injection. The characteristics and usage of these chlorinated hydrocarbon compounds are described in detail in Section 3.3.4 of this report. The levels of both aldrin and dieldrin were strikingly high at the Hilton Dock station along the eastern shore of the Bay. The 1983-84 SMW high of 33.0 ng/g of aldrin was measured there, which exceeded all of the other Mission Bay aldrin measurements and the aldrin ETPL 90 of 0.5 ng/g by a considerable margin. As aldrin is metabolically converted in the

- Mid to south San Diego Bay, where copper and zinc concentrations are high.

- The Point Loma area, where silver concentrations are high.

Results from the 1983-84 SMW sampling program (Figure 17) verified and clarified these previous findings, and identified some new areas where PCB and metal concentrations are high. These 1983-84 results are discussed in the following three sections.

3.3.13.1 PCBs in San Diego Bay

In response to earlier findings of the SMW program, the Regional Board and SMW worked to locate potential sources of the high concentrations of PCBs found in the northern portion of San Diego Bay. Further sampling found high concentrations of PCB 1248 and PCB 1254 in sediments and mussels near the mouth

The U. S. Food and Drug Administration has established a tolerance level for PCBs (USFDA, 1984). In 1984, this tolerance level was reduced from 5 ppm to 2 ppm, on a fresh weight basis. Samples taken by the SMW program are reported on a dry weight basis. Using the percent water of the mussel sample, these dry weight values can be converted to fresh weight (or wet weight) concentrations. PCB concentrations from stations 894 and 894.1, both in the East Basin, are listed on a dry weight basis and are converted to a fresh weight basis in the following table:

Station	Date Collected	PCB Concentration (dry weight)	% Water	PCB Concentration (wet weight)	USFDA Tolerance Level
894	12/29/82	24,000 ng/g	84.2	3.79 ppm	5 ppm
894.1	01/04/84	19,000 ng/g	89.4	2.01 ppm	2 ppm

At the time the December 1982 sample was taken, it did not exceed the USFDA tolerance level of 5 ppm in effect at the time. However, now that the tolerance level has been reduced, both the December 1982 and the January 1984 samples exceed the new USFDA tolerance level of 2 ppm PCBs. A water quality problem thus clearly exists in this area. State Mussel Watch sampling efforts should be continued in the East Basin area to follow PCB concentrations over time, and to evaluate the effectiveness of any actions taken by the Regional Board to clean up or abate the PCB contamination that is now present.

3.3.13.2 Silver in San Diego Bay

State Mussel Watch monitoring of the San Diego area has identified consistently

Past monitoring had found exceptionally high concentrations of silver along the seaward and bayward shorelines of Point Loma. While no stations were sampled in these areas in 1983-1984, samples were taken at Zuniga Jetty (903.0), which is near Point Loma. Silver concentrations there were 1.7 ug/g, which exceeds the ETPL 90 for silver concentrations in transplanted California mussels. Combined with information from earlier surveys, the 1983-84 results continue to indicate that a major source of silver exists somewhere in the Point Loma area. Additional SMW sampling should be conducted to better locate sources of silver in this area.

3.3.13.3 Copper and Other Metals in San Diego Bay

State Mussel Watch surveys from 1981 to 1983 identified a major source of copper and zinc in the 24th Street Marine Terminal area. Acting on this information, the California Regional Water Quality Control Board, San Diego Region, determined that an ore transfer facility at the 24th Street Marine Terminal was responsible for the high concentrations of copper and zinc. The Regional Board is in the process of taking action to require the operators of the ore transfer station to implement better pollution control measures at the facility to prevent further pollution of the area. Furthermore, since a sediment survey performed by the Regional Board indicated that extensive deposits of copper and zinc were present in the bottom sediments of the area, the Regional Board is also evaluating measures to cleanup or abate the pollutants now present as a result of past activities at the ore transfer station. The 1983-84 sampling efforts again showed extensive contamination of mussels transplanted to this area. Samples from the 24th Street Marine Terminal station (882.0), and the Pier 13 station (882.4), both exceeded the ETPL 75 for lead. Both samples also exceeded the ETPL 90 for copper and zinc in transplanted California mussels. Sampling of this area should be continued in the future to monitor the progress of cleanup and abatement efforts at the ore transfer facility.

Samples taken in 1983-84 from the northern shoreline of North Island also contained extensive metal contamination. Mussels from the North Island Platform station (898.4) exceeded the ETPL 75 for copper, mercury, lead, and zinc. Mussels from the North Island Launch Docks station (898.2) exceeded the ETPL 75 for lead, and exceeded the ETPL 90 for copper, mercury, and zinc. These metals may be coming from the extensive U.S. Naval activities along the northern portion of North Island. Since these were the first samples taken from this area, additional sampling along North Island is warranted to verify these results, and to help locate the sources of these elevated metal concentrations.

As in previous surveys of San Diego Bay, 1983-84 samples taken from the East Basin area were heavily contaminated with metals. The East Basin Soft Bottom samples (Station 894.1) exceeded the ETPL 75 for cadmium and copper, and exceeded the ETPL 90 for chromium, mercury, lead, and zinc. Samples from the East Basin Docks station (894.5) exceeded the ETPL 75 for cadmium, chromium, mercury, and zinc, and exceeded the ETPL 90 for copper and lead. These results, combined with the results of prior surveys, indicate that significant sources of a variety of toxic metals exist in the East Basin area. The 60-inch storm drain that is implicated as a source of PCBs may also be a likely source of metal contamination. Land surveys will be necessary to locate potential discharges of metals to this 60-inch storm drain.

In summary, the San Diego Bay area has been extensively sampled since 1979 by the State Mussel Watch program. These sampling efforts have identified several areas where concentrations of toxic substances are very high. The Regional Board, acting on this information, has been able to locate and identify the sources of some of these pollutants, and is in the process of working to identify potential sources for other pollutants. San Diego Bay is a good example of how the State Mussel Watch monitoring program can be put to effective use by a Regional Board to locate and abate pollution in marine waters of California.

3.3.14 IMPERIAL BEACH AND TIJUANA RIVER BASELINE SURVEYS

In 1983-84, SMW personnel collected resident California mussels from the Imperial Beach pier (Station 904.0), and transplanted California mussels from an area about one-half mile offshore of the mouth of the Tijuana River (Station 905.0).

The locations of these stations are shown on Figure 17. Neither of these areas had been sampled before by the SMW program.

At the Tijuana River station, silver was detected in concentrations that exceeded the ETPL 75 for transplanted California mussels. At the Imperial Beach pier station, both silver and copper concentrations exceeded the ETPL 75 for resident California mussels. Organic compounds were not looked for in the Imperial Beach pier samples. At the Tijuana River station, concentrations of all organic compounds that were looked for were less than the ETPL 75.

No source is known for the elevated copper concentrations found at the Imperial Beach pier station. Additional sampling would be necessary to learn more about the distribution and persistance of elevated copper levels in this area, and to help identify any potential sources of copper that may exist in this area.

The silver concentrations found at these two southernmost SMW stations are not as elevated as those found by the SMW program in the Point Loma area. The 1983-84 sample from the Zuniga Jetty, for example, exceeded the ETPL 90 for silver in transplanted California mussels. It is therefore possible that the source of the elevated silver concentrations found at the Imperial Beach pier and the Tijuana River stations is in the Point Loma area. It is also possible, however, that an additional source of silver exists in the vicinity of these two stations. Possible sources in this area include runoff from the Tijuana River, and sewage effluent from the City of Tijuana. Additional monitoring will be necessary to precisely identify the sources that are responsible for the elevated silver concentrations found at the Tijuana River and Imperial Beach stations.

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APPENDIX A

SUMMARY OF DATA

TRACE METALS 1977-1984

(ug/g Dry Weight)

CODE	SPECIES SAMPLED
BNC =	Bentnose Clam
FWC =	Freshwater Clam
LNC =	Littleneck Clam
OYS =	Oyster
RBM =	Resident Bay Mussel

STATE MUSSEL WATCH METALS

R E G	STATION NAME	STA NUM	SAMPLE DATE	TYPE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
1	CRESCENT CITY HARBOR	1.0	08MAY80	TCM	0.075	298.3	N	11.7	1.6	5.9	0.364	10.1	4.2	2.3	N	N	106.7
1	CRESCENT CITY STP	2.0	22MAR83	RCM	9.927	600.0	15.1	3.3	3.9	11.1	0.926	17.5	N	1.4	4.4	N	158.3
1	CRESCENT CITY STP	2.0	20SEP83	RCM	2.494	192.8	N	3.5	4.1	9.3	0.446	9.3	N	2.4	N	N	143.3
1	CRESCENT CITY CONT.	3.0	22MAR83	RCM	0.620	682.7	18.2	5.6	4.6	9.3	0.295	17.9	N	1.1	5.7	N	152.8
1	CRESCENT CITY CONT.	3.0	20SEP83	RCM	0.064	273.3	N	5.3	3.4	8.1	0.211	14.1	N	1.5	N	N	146.1
1	REDWOODS NORTH	5.0	08NOV77	RCM	0.047	246.7	N	2.5	2.7	7.9	0.062	12.0	5.3	0.7	N	N	78.7
1	REDWOODS NORTH	5.0	24JUL78	RCM	0.110	196.0	N	5.4	2.3	5.0	0.161	9.3	N	1.4	N	N	96.0
1	REDWOODS NORTH	5.0	19NOV78	RCM	0.063	709.3	N	4.0	4.2	5.8	0.100	14.4	N	1.4	N	N	107.2
1	REDWOODS SOUTH	7.0	06JUL77	RCM	0.037	121.7	N	4.7	4.3	6.9	0.128	10.3	5.3	0.7	N	N	77.7
1	TRINIDAD HEAD	10.0	07JUL77	RCM	0.040	223.3	N	3.3	2.4	6.8	0.091	10.2	3.0	0.9	N	N	86.7
1	TRINIDAD HEAD	10.0	09NOV77	RCM	0.027	246.7	N	3.2	2.6	7.1	0.081	10.6	2.9	0.9	N	N	74.7
1	TRINIDAD HEAD	10.0	24JUL78	RCM	0.057	128.0	N	3.9	1.4	4.1	0.156	5.6	N	0.9	N	N	80.0
1	TRINIDAD HEAD	10.0	19NOV78	RCM	0.047	368.8	N	4.0	2.6	5.9	0.212	10.4	N	1.1	N	N	93.3
1	TRINIDAD HEAD	10.0	16JAN81	RCM	0.063	576.7	N	6.3	3.0	9.6	0.207	11.3	N	2.1	N	N	129.3
1	TRINIDAD HEAD	10.0	12JAN82	RCM	0.120	456.7	6.8	5.5	2.2	6.8	0.094	11.1	N	1.6	2.7	N	149.7
1	TRINIDAD HEAD	10.0	16SEP82	RCM	0.042	362.7	13.0	5.2	2.4	6.1	0.181	11.2	N	0.9	3.2	N	122.9
1	TRINIDAD HEAD	10.0	21SEP83	RCM	0.056	399.6	N	5.1	4.1	7.5	0.167	12.3	N	1.9	N	N	128.6
1	MAD RIVER SLOUGH	100.0	16DEC82	TCM	0.137	835.1	N	7.9	4.4	9.6	0.303	28.6	N	1.8	4.3	N	148.7
1	MAD RIVER SLOUGH	100.0	15FEB84	TCM	0.079	836.2	N	3.9	4.7	12.2	0.249	28.3	N	2.4	N	N	169.2
1	ARCATA DOCK	100.5	15FEB84	TCM	0.091	877.0	N	4.5	6.2	9.9	0.272	26.2	N	1.2	N	N	183.0
1	SAMOA BRIDGE WEST	101.0	08MAY80	TCM	0.100	963.3	N	14.8	2.6	7.9	0.440	19.9	6.4	3.3	N	N	163.3
1	SAMOA BRIDGE WEST	101.0	04NOV80	TCM	0.337	411.3	N	4.7	1.6	8.4	0.172	14.4	N	1.0	N	N	102.3
1	SAMOA BRIDGE WEST	101.0	12JAN82	TCM	0.200	694.7	N	6.5	3.0	8.5	0.092	15.4	N	1.4	N	N	147.0
1	SAMOA BRIDGE WEST	101.0	16DEC82	TCM	0.103	674.5	N	8.0	3.6	9.0	0.413	25.7	N	1.8	N	N	159.2
1	SAMOA BRIDGE WEST	101.0	15FEB84	TCM	0.078	1306.9	N	3.8	9.3	9.7	0.249	34.4	N	1.1	N	N	167.4
1	SAMOA BRIDGE EAST	102.0	08MAY80	RBM	0.047	833.3	N	9.8	2.2	7.6	0.525	17.6	5.3	2.5	N	N	136.7
1	SAMOA BRIDGE EAST	102.0	04NOV80	TCM	0.133	505.7	N	5.5	2.0	9.1	0.169	17.0	N	1.9	N	N	108.7
1	SAMOA BRIDGE EAST	102.0	12JAN82	TCM	0.073	751.0	N	10.4	3.5	9.4	0.125	15.2	N	1.6	N	N	151.7
1	WOODLEY ISLAND	102.5	15FEB84	TCM	0.173	1820.4	N	5.4	13.1	10.7	0.259	39.9	N	4.4	N	N	214.9
1	EUREKA CHANNEL	103.0	08MAY80	RBM	0.118	990.0	N	15.9	3.0	7.1	0.545	19.6	5.7	3.7	N	N	153.3
1	EUREKA CHANNEL	103.0	04NOV80	TCM	0.153	578.0	N	6.0	2.2	7.3	0.202	14.2	N	1.8	N	N	90.0
1	EUREKA CHANNEL	103.0	12JAN82	TCM	0.267	537.3	N	9.7	3.3	7.8	0.187	13.1	N	1.7	N	N	145.7
1	EUREKA CHANNEL	103.0	16DEC82	TCM	0.139	536.7	N	3.5	2.7	6.9	0.191	14.1	N	1.1	N	N	108.1
1	EUREKA STP 1	104.0	21SEP83	TCM	0.132	367.2	N	4.1	2.7	8.1	0.081	10.9	N	0.9	N	N	107.6
1	EUREKA STP 1	104.0	15FEB84	TCM	0.122	1612.8	N	5.1	10.1	11.2	0.262	37.6	N	2.1	N	N	213.1
1	EUREKA STP CONTROL	104.5	15FEB84	TCM	0.060	1136.4	N	5.8	7.1	10.5	0.243	26.2	N	1.5	N	N	178.5
1	HUMBOLDT BAY ENTRANC	105.0	08JUL77	RCM	0.043	130.0	N	3.6	2.2	6.6	0.108	10.3	2.5	1.4	N	N	86.3
1	HUMBOLDT BAY ENTRANC	105.0	10NOV77	RCM	0.030	256.7	N	5.1	3.6	7.8	0.133	10.3	3.4	1.9	N	N	120.3
1	HUMBOLDT BAY ENTRANC	105.0	25JUL78	RCM	0.063	184.0	N	4.6	1.8	4.9	0.227	9.1	N	1.5	N	N	106.7
1	HUMBOLDT BAY ENTRANC	105.0	19NOV78	RCM	0.063	986.7	N	2.6	4.2	7.6	0.147	20.0	N	1.1	N	N	74.7
1	HUMBOLDT FIELDS LAND	106.0	12JAN82	TCM	0.077	624.7	N	9.4	2.8	8.2	0.114	14.6	N	1.3	N	N	149.0
1	SHELTER COVE	130.0	09JUL77	RCM	0.263	246.7	N	5.1	2.1	6.7	0.196	10.1	2.4	1.2	N	N	92.7
1	SHELTER COVE	130.0	12NOV77	RCM	0.183	396.7	N	7.6	3.3	7.4	0.276	14.3	3.1	1.1	N	N	110.0
1	SHELTER COVE	130.0	26AUG78	RCM	0.267	208.0	N	6.3	2.0	4.8	0.260	5.9	N	1.3	N	N	117.3
1	SHELTER COVE	130.0	02DEC78	RCM	0.280	442.7	N	6.3	2.2	5.5	0.265	10.1	N	1.7	N	N	141.3
1	PYGMY FOREST	153.0	11JUL77	RCM	0.073	126.7	N	3.3	1.6	6.3	0.093	5.8	2.8	0.8	N	N	106.7
1	PYGMY FOREST	153.0	13NOV77	RCM	0.093	343.3	N	3.4	2.3	6.9	0.108	8.7	2.7	0.8	N	N	106.7

STATE MUSSEL WATCH METALS

MPLE TE	TYPE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
JUL78	RCM	0.183	42.1	N	7.0	1.4	4.0	0.283	5.7	N	1.2	N	N	109.3
DEC78	RCM	0.087	190.7	N	4.0	1.3	3.8	0.276	3.2	N	0.7	N	N	109.3
JUL77	RCM	0.157	88.7	N	6.7	1.6	6.1	0.207	4.5	2.7	1.8	N	N	113.3
NOV77	RCM	0.120	220.0	N	4.4	2.0	7.4	0.111	6.8	2.9	1.5	N	N	91.3
AUG78	RCM	0.147	41.3	N	3.8	1.0	4.1	0.292	2.6	N	1.5	N	N	101.3
DEC78	RCM	0.257	316.3	N	7.8	2.2	4.4	0.397	4.7	N	3.2	N	N	114.7
JAN84	RCM	0.076	605.7	N	5.3	4.7	8.0	0.354	21.1	N	2.2	N	N	191.4
JUN80	TCM	0.112	160.0	N	9.5	0.9	5.0	0.180	5.6	2.3	1.6	N	N	90.0
NOV80	TCM	0.173	274.0	N	6.9	1.1	4.7	0.185	5.6	N	1.0	N	N	67.0
JUL77	RCM	0.053	51.3	N	6.8	1.5	5.0	0.167	4.0	1.8	0.9	N	N	94.3
NOV77	RCM	0.130	200.0	N	9.5	2.7	5.4	0.209	6.2	3.4	1.2	N	N	107.7
AUG78	RCM	0.187	44.0	N	6.6	1.3	3.8	0.289	3.5	N	1.5	N	N	93.3
DEC78	RCM	0.250	257.1	N	10.9	2.4	4.1	0.393	4.3	N	1.1	N	N	122.7
OCT79	RCM	0.147	460.0	N	16.3	1.7	4.0	0.446	6.3	2.8	2.0	N	N	116.7
FEB81	RCM	0.083	206.7	N	9.1	1.5	4.7	0.162	9.5	N	0.8	N	N	83.0
FEB82	RCM	0.100	214.7	10.6	11.0	1.6	5.7	0.087	5.8	N	1.0	1.8	N	147.7
AUG81	RCM	0.130	265.3	4.2	14.5	2.0	5.3	0.163	5.6	N	1.4	2.0	N	148.7
OCT81	RCM	0.083	285.3	N	11.5	1.8	4.8	N	7.0	N	0.8	N	N	127.3
AUG82	RCM	0.086	317.7	12.4	8.0	1.6	5.1	0.230	5.5	N	1.0	2.7	N	106.5
SEP83	RCM	0.143	302.6	N	10.3	3.1	6.1	0.314	9.3	N	2.2	N	N	177.6
APR84	RCM	0.092	240.5	N	8.7	1.5	4.8	0.297	6.3	3.0	0.9	N	24.6	120.5
JUN80	TCM	0.049	590.0	N	6.0	1.4	4.0	0.123	19.8	2.3	1.3	N	N	63.7
OCT79	RBM	0.038	566.7	N	3.7	1.3	3.8	0.140	14.7	2.6	1.1	N	N	98.0
NOV80	TCM	0.113	375.0	N	4.4	1.5	6.4	0.170	21.2	N	0.8	N	N	62.3
FEB82	RBM	0.467	762.7	7.9	4.4	2.4	4.7	0.202	28.5	N	0.5	3.4	N	88.9
JUL77	RCM	0.370	36.0	N	6.3	2.0	6.2	0.184	4.1	2.2	1.9	N	N	120.0
NOV77	RCM	0.920	173.3	N	7.8	2.1	7.0	0.229	6.5	2.7	3.0	N	N	133.3
AUG78	RCM	0.470	86.9	N	9.6	1.7	4.4	0.383	4.2	N	2.9	N	N	154.7
DEC78	RCM	0.473	149.1	N	5.9	1.2	4.4	0.372	4.2	N	2.2	N	N	146.9
JUN80	TCM	0.084	403.3	N	9.5	1.2	5.1	0.174	7.5	1.9	2.0	N	N	103.3
JUN80	RBM	0.055	486.7	N	4.7	0.9	5.1	0.133	8.5	2.2	1.1	N	N	99.7
NOV80	TCM	0.477	339.0	N	7.0	1.3	7.2	0.182	7.0	N	1.1	N	N	92.3
JUN80	RBM	0.023	1023.3	N	4.4	2.3	7.5	0.170	20.3	4.6	1.6	N	N	62.0
DEC82	TCM	0.147	1526.4	13.6	11.7	6.1	12.7	0.305	31.7	N	4.4	3.7	N	209.0
JUN80	RBM	0.022	880.0	N	4.3	1.5	5.3	0.165	30.1	3.6	1.3	N	N	89.3
JAN81	TCM	0.330	622.7	N	19.5	3.0	14.2	0.348	21.1	N	2.5	N	N	184.0
FEB82	TCM	0.090	453.0	8.5	19.9	2.7	9.7	0.477	9.8	N	2.1	2.7	N	272.0
DEC82	TCM	0.146	439.6	N	10.4	2.5	9.2	0.332	12.0	N	2.2	N	N	218.4
DEC82	TCM	0.171	188.0	N	10.1	2.0	7.9	0.256	10.2	N	1.4	N	N	200.0
DEC83	TCM	0.155	239.1	N	11.8	4.0	9.6	0.500	9.3	N	1.4	N	N	236.6
JUN80	TCM	0.217	620.0	N	11.5	1.7	6.9	0.234	24.5	4.1	4.0	N	N	190.0
JAN81	TCM	1.067	443.3	N	10.8	2.5	11.2	0.295	22.8	N	2.4	N	N	152.0
FEB82	TCM	1.133	615.7	12.8	13.6	2.8	13.4	0.149	19.3	N	2.4	6.8	N	232.3
DEC82	TCM	0.465	667.1	N	8.6	3.2	10.9	0.332	21.1	N	1.7	N	N	232.7
DEC82	TCM	0.614	312.5	N	10.8	2.3	9.6	0.342	14.4	N	2.4	N	N	240.5
FEB82	TCM	0.333	490.0	8.0	7.3	2.6	10.9	0.206	20.0	N	5.7	3.0	N	214.3
JUN80	TCM	0.256	906.3	N	15.0	2.3	7.0	0.166	21.4	4.2	3.6	N	N	175.0

STATE MUSSEL WATCH METALS

REG	STATION NAME	STA NUM	SAMPLE DATE	TYPE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
2	ANGEL ISLAND	305.0	26JAN81	TCM	1.040	515.3	N	7.2	2.4	10.3	0.225	18.6	N	2.5	N	N	125.0
2	ANGEL ISLAND	305.0	02FEB82	TCM	1.467	407.0	N	9.4	2.6	11.1	0.086	20.0	N	3.0	N	N	199.0
2	ANGEL ISLAND	305.0	07DEC82	TCM	0.378	356.8	N	7.6	1.5	9.3	0.304	14.1	N	2.3	N	N	207.2
2	SF ANGEL	305.0	07DEC82	TCM	0.489	216.4	N	7.7	1.4	8.3	0.301	12.2	N	2.3	N	N	195.8
2	FORT BAKER	306.0	27JAN81	TCM	1.083	350.3	N	10.6	1.7	12.1	0.261	15.6	N	3.7	N	N	116.0
2	FORT BAKER	306.0	07DEC82	TCM	0.492	623.1	N	7.8	2.2	8.9	0.283	18.3	N	2.8	N	N	192.2
2	FORT BAKER	306.0	07DEC82	TCM	0.671	250.9	N	6.8	1.4	7.8	0.284	12.4	N	2.7	N	N	200.9
2	FORT BAKER	306.0	02NOV82	TCM	0.279	571.3	N	9.6	2.0	8.5	0.204	22.1	N	2.3	N	N	172.4
2	TREASURE ISLAND	307.0	04JUN80	TCM	0.427	820.0	N	12.5	2.2	7.8	0.237	22.6	4.4	4.3	N	N	196.7
2	TREASURE ISLAND	307.0	04JUN80	RBM	0.162	763.3	N	4.4	1.5	6.5	0.196	19.4	3.2	2.1	N	N	130.0
2	TREASURE ISLAND	307.0	26JAN81	TCM	1.400	641.3	N	9.4	2.6	10.5	0.201	29.4	N	2.3	N	N	137.3
2	TREASURE ISLAND	307.0	02FEB82	TCM	1.300	777.3	10.2	8.3	3.6	12.2	0.226	22.3	N	3.7	2.8	N	226.7
2	TREASURE ISLAND	307.0	07DEC82	TCM	0.710	437.6	N	7.7	2.0	10.6	0.341	16.9	N	2.2	N	N	205.2
2	TREASURE ISLAND	307.0	07DEC82	TCM	0.522	240.8	N	10.0	1.7	9.8	0.341	14.4	N	1.6	N	N	211.4
2	TREASURE ISLAND	307.0	02NOV82	TCM	0.431	760.2	N	8.2	2.6	11.4	0.322	31.7	N	2.4	N	N	195.8
2	TREASURE ISLAND	307.0	14DEC83	TCM	0.409	812.5	N	9.1	6.5	10.7	0.471	21.6	N	3.5	N	N	256.7
2	HUNTER'S POINT	308.0	26JAN81	TCM	1.133	689.3	N	12.1	2.8	12.2	0.305	23.1	N	2.8	N	N	160.3
2	HUNTER'S POINT	308.0	18JAN82	TCM	1.333	667.0	10.7	11.8	3.8	10.9	0.231	18.9	N	2.9	2.6	N	229.3
2	HUNTER'S POINT	308.0	07DEC82	TCM	0.869	420.5	N	11.8	2.0	12.0	0.373	15.4	N	2.9	N	N	272.3
2	HUNTER'S POINT	308.0	07DEC82	TCM	0.380	183.2	N	8.8	1.2	9.0	0.334	10.0	N	1.6	N	N	178.1
2	HUNTER'S POINT	308.0	02NOV82	TCM	0.584	640.8	N	12.4	3.1	12.8	0.354	27.9	N	2.1	N	N	232.8
2	HUNTER'S POINT	308.0	09DEC82	RBM	0.315	503.3	N	6.8	1.9	7.4	0.361	26.2	N	1.3	N	N	136.8
2	SAN MATEO BRIDGE 8	309.0	20MAY80	TCM	1.397	920.0	N	11.3	2.6	6.4	0.345	26.9	6.5	3.1	N	N	156.7
2	SAN MATEO BRIDGE 8	309.0	09FEB81	TCM	1.860	660.0	N	18.9	3.0	13.9	0.435	26.3	N	2.6	N	N	198.0
2	SAN MATEO BRIDGE 8	309.0	18JAN82	TCM	1.233	349.7	11.8	12.1	2.7	10.6	0.321	12.9	N	2.1	2.1	N	321.0
2	SAN MATEO BRIDGE 8	309.0	09DEC82	TCM	0.759	364.4	N	10.9	2.0	8.8	0.365	15.0	N	1.5	N	N	216.4
2	SAN MATEO BRIDGE 8	309.0	09DEC82	TCM	0.427	164.7	N	11.6	1.8	7.2	0.389	12.3	N	1.2	N	N	196.6
2	SAN MATEO BRIDGE 8	309.0	02NOV82	TCM	0.451	409.4	N	10.2	2.2	8.3	0.343	19.2	N	2.8	N	N	201.0
2	SAN MATEO BRIDGE 8	309.0	02NOV82	RBM	0.401	892.2	N	6.1	2.7	8.3	0.308	35.7	N	1.3	N	N	128.1
2	SAN MATEO BRIDGE 8	309.0	14DEC83	TCM	0.295	194.9	N	13.0	4.1	10.1	0.313	27.4	N	2.0	N	N	285.4
2	SAN MATEO BRIDGE 8A	310.0	18JAN82	TCM	0.400	250.0	N	14.4	2.1	6.4	N	9.8	N	2.3	N	N	244.0
2	SAN MATEO OLD BRIDGE	311.0	18JAN82	TCM	0.667	219.0	N	11.3	1.9	9.2	N	10.9	N	2.4	N	N	224.0
2	BELMONT SLOUGH	312.0	02FEB82	TCM	0.900	441.3	10.5	17.2	2.6	12.3	0.334	21.8	N	2.3	2.1	N	236.3
2	REDWOOD CREEK MOUTH	313.0	26JAN81	TCM	4.353	750.3	N	12.5	3.6	15.6	0.563	28.9	N	2.8	N	N	162.3
2	REDWOOD CREEK MOUTH	313.0	11JAN82	TCM	1.133	396.3	13.7	13.5	2.6	9.2	0.371	12.7	N	1.7	1.8	N	223.0
2	REDWOOD CREEK MOUTH	313.0	09DEC82	TCM	1.432	460.0	N	8.5	2.4	10.0	0.503	22.0	N	1.9	5.5	N	201.0
2	REDWOOD CREEK MOUTH	313.0	09DEC82	TCM	1.001	171.8	N	10.1	1.8	9.0	0.405	13.8	N	1.4	N	N	214.3
2	REDWOOD CREEK MOUTH	313.0	26OCT82	TCM	0.772	515.4	N	9.0	2.5	9.7	0.419	28.2	N	1.4	N	N	199.5
2	REDWOOD CREEK MOUTH	313.0	26OCT82	RBM	0.549	557.6	N	6.4	2.0	6.4	0.485	28.5	N	1.1	N	N	138.5
2	REDWOOD CREEK MOUTH	313.0	14DEC83	TCM	0.323	332.1	N	12.2	2.7	5.9	0.511	14.2	N	1.7	N	N	240.4
2	REDWOOD CREEK 10	314.0	18JAN82	TCM	2.933	335.7	9.4	10.3	2.0	9.8	0.329	26.9	N	2.9	1.9	N	287.7
2	REDWOOD CREEK TOWERS	315.0	18JAN82	TCM	22.533	282.3	N	10.6	2.4	15.0	N	31.0	N	8.7	N	N	317.3
2	REDWOOD CREEK TOWERS	315.0	09DEC82	TCM	1.840	473.1	N	7.1	2.0	11.0	0.503	35.5	N	5.0	N	N	270.3
2	REDWOOD CREEK TOWERS	315.0	26OCT82	TCM	1.509	404.0	N	8.2	2.2	11.1	0.405	30.8	N	4.4	N	N	195.9
2	REDWOOD CREEK TOWERS	315.0	26OCT82	RBM	0.970	307.3	N	6.4	1.6	8.8	0.691	28.5	N	4.9	N	N	110.6
2	REDWOOD CRK TROWNDS	316.0	04JUN80	RBM	0.086	513.3	N	5.6	1.3	7.5	0.296	39.9	3.4	3.2	N	N	102.7
2	REDWOOD CRK TROWNDS	316.0	18JAN82	TCM	19.733	286.3	N	7.7	2.6	16.8	N	20.3	N	8.0	N	N	271.7

TI	ZN
N	253.4
N	203.1
N	132.1
N	239.2
N	227.5
N	214.7
N	234.2
N	81.7
N	200.0
N	206.7
N	195.0
N	129.0
N	332.5
N	230.0
N	253.3
N	244.3
N	115.4
N	223.3
N	244.3
N	76.3
N	89.3
N	156.7
N	150.0
N	150.0
N	160.0
N	146.7
N	170.0
N	153.3
N	96.0
N	107.0
N	143.3
N	109.3
N	110.7
N	120.0
N	130.0
N	107.3
N	101.3
N	95.3
N	131.7
N	172.1
N	116.7
N	100.3
N	159.7
N	150.7
N	307.9
N	63.3
N	126.7

STATE MUSSEL WATCH METALS

PE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
M	0.159	226.0	N	11.0	1.7	5.6	0.136	6.2	1.8	3.8	N	N	89.2
M	0.110	374.0	N	10.3	1.6	6.8	0.116	7.7	N	1.3	N	N	66.7
M	2.733	266.7	N	7.0	1.3	7.3	0.506	5.5	1.3	5.8	N	N	230.0
M	3.067	133.7	N	8.7	1.6	7.2	0.073	6.2	N	3.4	N	N	254.5
M	1.294	193.5	N	7.6	1.4	5.9	0.256	4.7	N	3.1	N	N	211.5
M	1.420	288.2	N	7.2	4.1	8.6	N	5.5	N	3.2	N	N	249.3
M	1.320	46.0	N	7.1	0.9	4.4	0.259	2.8	N	3.9	N	N	124.0
M	0.123	160.1	N	8.3	1.3	5.1	0.217	4.4	N	3.4	N	N	232.2
M	2.073	19.7	N	12.0	1.8	5.7	0.177	2.7	2.3	9.8	N	N	206.7
M	2.567	64.3	N	8.8	1.4	6.8	0.113	3.5	2.8	7.3	N	N	176.7
M	1.567	17.9	N	6.7	0.9	3.9	0.332	2.4	N	7.6	N	N	181.3
M	2.000	103.2	N	10.2	1.4	4.4	0.371	3.4	N	9.5	N	N	216.0
M	0.280	306.7	N	7.0	1.5	6.2	0.358	3.5	1.5	38.3	N	N	260.0
M	0.200	150.3	N	6.7	1.1	5.1	0.134	6.1	N	5.2	N	N	165.0
M	1.267	205.3	N	8.5	1.3	3.3	0.137	7.5	N	6.7	N	N	260.0
M	1.581	252.4	N	5.7	1.2	7.2	0.280	6.6	N	6.8	N	N	264.2
M	0.464	327.9	N	4.1	2.0	9.3	0.193	7.8	N	3.3	N	N	288.7
M	0.300	100.7	N	3.6	0.9	7.8	0.067	6.2	N	15.9	N	N	274.7
M	0.170	203.6	N	4.9	1.1	5.7	0.167	4.3	N	16.7	N	N	252.7
M	2.867	280.0	N	8.9	1.2	7.6	0.293	4.2	1.5	8.8	N	N	250.0
M	0.427	70.3	N	12.5	1.4	5.2	0.159	3.5	N	9.6	N	N	158.7
M	0.267	82.3	N	7.4	1.6	6.4	0.070	5.2	N	12.1	N	N	252.7
M	0.214	194.9	N	4.6	1.2	4.8	0.172	5.2	N	10.0	N	N	223.9
M	0.263	86.0	N	3.4	0.6	7.4	0.219	4.2	N	7.2	N	N	110.3
M	0.049	51.3	N	1.8	1.0	2.5	0.278	6.4	N	26.4	N	N	260.0
M	0.277	77.7	N	3.9	0.6	7.4	0.142	3.3	N	10.8	N	N	109.7
M	0.047	95.3	N	3.1	0.9	6.8	0.017	5.3	N	21.6	N	N	206.0
M	0.143	255.9	N	2.2	1.0	5.9	0.225	5.6	N	29.6	N	N	239.4
M	0.360	97.0	N	2.9	0.8	9.4	0.157	3.8	N	48.5	N	N	181.0
M	0.942	922.3	N	3.3	6.1	15.5	0.427	11.8	N	91.8	N	N	479.6
M	0.610	561.5	N	4.0	3.5	9.9	N	7.4	N	91.7	N	N	354.5
M	0.245	269.8	N	1.7	3.7	21.2	N	12.0	N	1826.0	N	N	1128.3
M	0.086	408.4	N	4.5	2.8	18.3	N	7.4	N	37.6	N	N	582.0
M	0.150	481.4	N	7.9	3.5	25.6	N	7.0	N	86.1	N	N	634.8
M	0.077	632.6	N	3.2	2.8	11.4	N	9.3	N	5.8	N	N	226.5
M	0.337	286.7	N	10.4	1.3	5.7	0.283	5.8	1.2	3.1	N	N	196.7
M	1.047	23.7	N	5.4	1.1	5.6	0.040	3.2	2.0	4.0	N	N	140.0
M	1.013	67.3	N	7.0	1.5	6.6	0.083	4.0	2.3	3.2	N	N	136.7
M	0.697	21.9	N	3.6	0.6	3.1	0.166	2.3	N	2.6	N	N	104.0
M	0.677	46.9	N	3.9	1.0	4.2	0.191	2.3	N	2.4	N	N	122.7
M	0.501	53.6	N	7.0	1.2	5.8	0.208	3.7	N	2.0	N	N	193.3
M	0.608	105.6	N	7.4	1.6	3.0	0.320	5.3	2.2	2.6	N	N	152.9
M	1.768	126.0	N	5.3	1.3	4.8	0.211	5.5	2.1	2.4	N	N	122.3
M	1.125	137.7	N	4.4	1.3	4.7	0.204	4.9	1.6	2.4	N	N	116.4
M	0.950	14.7	N	8.5	1.3	5.9	0.113	3.0	1.6	2.3	N	N	146.7
M	1.867	44.3	N	7.9	1.4	7.4	0.136	3.7	2.1	3.8	N	N	163.3
M	0.730	13.6	N	7.0	0.9	4.5	0.207	2.2	N	1.7	N	N	122.7

CU	HG	MN	NI	PB	SE	TI	ZN
4.4	0.147	2.5	N	1.8	N	N	128.0
4.6	0.226	4.9	N	1.8	N	N	193.7
6.4	0.080	3.6	1.3	1.8	N	N	95.0
5.4	0.063	2.8	0.8	1.7	N	N	100.0
4.6	0.129	3.5	N	2.3	N	N	114.7
3.6	0.108	2.8	N	1.0	N	N	74.7
4.6	0.167	5.1	N	2.0	N	N	165.4
6.7	0.082	5.6	3.8	1.7	N	N	92.3
6.3	0.090	6.0	4.7	1.5	N	N	103.3
4.4	0.227	3.7	N	1.5	N	N	114.7
5.4	0.207	7.2	N	1.9	N	N	141.3
4.3	0.122	8.9	N	0.8	N	N	161.0
8.2	0.218	11.3	6.7	1.4	N	35.4	146.9
5.4	0.300	12.6	7.6	1.8	N	N	116.7
6.5	0.152	7.5	N	1.4	N	N	103.3
8.3	0.362	9.6	5.0	1.6	N	22.5	213.4
7.2	0.142	9.3	3.2	2.4	N	N	100.7
7.1	0.153	7.9	N	0.8	N	N	104.0
5.1	0.102	5.4	N	1.0	N	N	109.1
5.4	0.184	6.1	N	1.4	N	N	173.0
6.2	0.194	5.6	1.5	1.7	N	N	123.3
5.1	0.081	4.5	N	1.1	N	N	98.0
5.5	0.178	4.8	N	1.5	N	N	166.7
3.7	0.071	6.7	N	0.8	N	N	145.0
4.3	0.202	1.8	N	1.3	N	N	164.3
5.1	0.058	1.6	2.5	1.5	N	2.6	160.6
6.4	0.097	3.1	3.7	2.6	N	17.9	217.8
6.2	0.082	4.9	4.2	1.6	N	45.4	199.2
7.1	0.134	5.2	3.8	1.2	N	25.2	147.3
6.1	0.085	2.9	2.7	0.8	N	N	97.7
7.3	0.102	3.3	2.5	1.0	N	N	100.0
4.9	0.156	2.9	N	0.9	N	N	90.7
5.1	0.213	2.5	N	1.1	N	N	117.3
7.5	0.343	4.2	N	1.5	N	N	178.0
6.7	0.291	5.2	N	1.3	N	N	162.6
5.0	0.081	8.6	N	0.9	N	N	168.3
6.2	0.104	3.7	1.3	0.9	N	3.8	162.7
7.3	0.142	3.8	2.4	1.1	N	107.7	212.5
7.7	0.389	6.7	3.4	1.8	N	19.1	218.5
4.1	0.495	3.1	N	1.9	N	N	160.6
5.9	0.856	4.6	N	3.6	N	N	196.1
4.9	0.167	8.2	N	2.1	N	N	241.0
3.8	0.117	3.8	2.1	1.5	N	39.0	250.2
5.6	0.292	3.6	2.2	1.5	N	42.1	221.9
7.6	0.629	5.2	4.0	2.9	N	17.7	297.8
6.3	0.295	4.7	N	1.6	N	N	191.2
6.8	0.218	10.7	N	1.5	N	N	208.4

MUSSEL WATCH METALS

L	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
2.4	30.1	7.7	2.6	6.4	0.265	10.1	N	1.9	N	N	231.6
9.7	N	5.2	4.2	5.7	0.130	3.4	2.4	1.0	N	8.2	206.7
3.6	N	8.0	5.9	6.5	0.422	4.1	3.9	2.3	N	11.6	260.7
3.2	N	6.4	2.7	8.4	0.157	6.3	3.9	10.9	N	16.9	265.2
2.1	20.0	10.5	1.9	6.3	0.302	3.5	N	2.3	N	N	179.7
0.8	20.5	7.9	2.0	5.9	0.310	4.2	N	2.2	N	N	207.8
3.4	31.8	12.3	3.3	6.9	0.256	7.6	N	3.8	N	N	328.6
8.5	31.1	6.0	4.1	5.7	0.283	5.0	1.9	1.9	N	6.1	185.3
4.5	32.6	9.8	5.6	7.9	0.439	6.0	3.6	2.1	N	14.7	250.8
1.4	N	8.8	3.1	7.6	0.126	5.2	3.3	1.7	N	14.7	226.6
4.7	20.4	11.1	2.1	6.3	0.231	3.9	N	2.6	N	N	185.0
2.3	19.6	8.3	2.7	6.1	0.225	4.3	N	9.4	N	N	205.0
9.7	22.4	8.3	3.1	7.1	0.156	7.9	N	D	N	N	231.9
3.0	27.0	6.0	5.1	5.4	0.269	4.8	1.8	1.8	N	36.6	244.1
3.5	28.1	8.2	8.0	7.4	0.372	5.6	3.6	4.9	N	12.0	312.1
1.1	N	7.4	3.5	7.1	0.067	4.4	2.8	2.5	N	12.4	258.6
6.4	17.6	9.3	0.9	6.0	0.190	3.6	N	1.4	N	N	118.1
0.1	29.4	5.7	1.7	6.5	0.710	4.7	N	1.4	N	N	163.4
3.8	33.0	5.4	1.6	5.4	0.426	9.0	N	0.8	N	N	173.0
4.4	18.5	4.3	3.2	6.0	0.348	4.8	1.4	2.3	N	6.5	137.6
5.6	46.9	6.1	3.3	6.4	0.942	5.4	3.3	2.3	N	9.7	214.2
7.8	45.4	8.4	2.5	7.4	0.735	5.9	3.5	2.1	N	79.1	235.1
4.0	27.9	6.3	1.4	5.0	0.201	4.5	N	1.6	N	N	131.4
9.3	21.4	6.5	1.8	4.6	0.253	7.5	N	1.1	N	N	181.3
7.6	32.6	4.3	2.2	6.8	0.229	10.3	N	1.7	N	N	173.3
0.7	N	5.6	4.8	6.9	0.422	5.5	3.1	3.4	N	11.3	205.4
9.3	N	6.2	4.5	7.2	0.439	6.1	4.1	3.6	N	10.8	267.5
8.7	N	6.8	3.0	8.0	0.211	7.7	4.2	2.7	N	27.0	261.5
2.5	28.4	5.9	1.3	5.4	0.270	7.3	N	2.4	N	N	143.2
2.5	25.6	6.6	1.9	5.1	0.286	7.5	N	3.6	N	N	203.1
8.2	32.7	9.0	2.6	6.9	0.254	10.6	N	4.9	N	N	242.2
7.2	N	5.6	2.8	8.4	0.398	5.1	4.0	4.9	N	7.2	234.6
7.0	N	9.0	2.5	9.9	0.181	7.1	4.1	3.3	N	57.9	246.9
5.2	25.8	11.4	3.3	5.3	0.113	10.2	N	2.4	N	N	233.3
7.1	23.8	3.5	5.5	5.8	0.200	6.1	4.0	1.8	N	27.7	190.8
1.6	N	8.5	8.6	8.3	0.207	8.4	5.3	4.0	N	200.2	262.5
9.7	N	7.2	2.8	7.6	0.217	7.0	5.0	1.6	N	32.9	201.3
0.8	25.9	9.3	3.4	4.3	0.168	9.7	N	2.0	N	N	214.1
5.8	N	7.0	6.8	6.7	0.142	7.9	4.5	2.1	N	55.4	237.7
2.5	N	6.0	6.9	6.7	0.080	7.0	5.2	1.9	N	192.0	229.5
2.5	29.1	10.0	2.5	8.3	0.246	6.9	5.1	1.6	N	29.6	216.5
1.1	N	8.3	7.2	6.9	0.241	7.1	5.1	3.2	N	145.6	264.4
4.8	N	12.0	3.6	8.1	0.268	6.9	5.5	1.4	N	19.7	178.9
4.5	30.8	7.9	3.6	6.0	0.165	9.0	N	2.0	N	N	235.7
7.3	26.2	6.6	6.5	6.5	0.092	7.4	4.9	1.9	N	30.5	272.4
6.1	23.4	8.3	7.1	7.5	0.100	5.0	4.5	1.9	N	87.4	269.8
4.8	27.9	6.8	4.1	6.7	0.499	8.5	5.5	2.2	N	169.7	218.6

STATE MUSSEL WATCH METALS

S	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
42	570.7	23.8	6.2	7.3	8.7	0.149	7.4	4.2	4.1	N	96.0	273.4
95	301.3	20.6	9.2	3.9	8.9	0.334	7.6	3.8	2.4	N	20.6	222.1
44	564.2	19.6	6.0	2.7	7.0	0.188	9.4	N	2.7	N	N	171.9
04	696.8	17.8	4.4	7.3	7.5	0.086	11.5	5.3	3.1	N	138.1	190.5
95	207.9	21.1	5.8	2.4	10.3	0.186	7.6	3.0	1.7	N	57.3	156.1
73	85.3	N	5.1	1.6	7.6	0.102	3.5	1.6	3.9	N	N	143.3
47	266.7	N	7.2	3.0	6.5	0.098	5.6	2.0	5.9	N	N	143.3
53	205.1	N	4.9	2.0	4.9	0.159	6.2	N	2.2	N	N	117.6
43	123.2	N	4.5	1.6	4.9	0.142	3.4	N	1.0	N	N	99.5
90	113.3	N	6.3	2.9	5.7	0.129	4.4	1.4	5.4	N	N	150.0
07	123.0	N	6.5	3.2	5.5	0.138	4.3	1.2	3.9	N	N	170.0
33	53.6	N	3.9	1.8	4.8	0.154	3.4	N	1.6	N	N	98.7
33	100.0	N	4.7	1.8	5.4	1.133	4.1	N	1.2	N	N	101.3
27	42.0	N	6.8	2.0	6.8	0.526	3.9	0.8	1.6	N	N	123.3
10	67.3	N	5.6	1.9	5.4	0.441	3.1	0.6	1.5	N	N	130.0
93	70.9	N	9.3	1.6	4.4	0.742	2.6	N	2.4	N	N	133.3
40	53.6	N	4.4	1.1	4.0	0.500	1.8	N	1.2	N	N	96.0
83	11.3	N	12.0	1.6	5.4	0.090	2.3	0.8	2.5	N	N	120.0
33	25.7	N	11.0	1.8	4.1	0.081	2.4	0.6	2.7	N	N	133.3
50	19.7	N	6.9	1.6	3.8	0.211	2.5	N	2.4	N	N	122.7
17	14.4	N	8.5	1.0	3.2	0.112	1.9	N	1.7	N	N	96.0
23	74.0	N	7.4	1.6	4.4	0.059	4.4	1.0	1.4	N	N	106.3
13	33.7	N	6.1	1.6	4.4	0.081	2.2	1.3	1.9	N	N	133.3
33	50.4	N	7.2	1.5	4.7	0.179	3.8	N	1.4	N	N	128.0
00	41.3	N	6.6	1.3	4.0	0.142	2.4	N	1.6	N	N	117.3
00	30.0	N	6.1	1.9	5.5	0.116	2.3	1.2	5.1	N	N	170.0
00	14.3	N	5.5	2.0	3.9	0.083	1.3	0.9	3.9	N	N	156.7
67	20.8	N	5.8	1.4	4.7	0.178	2.7	N	5.9	N	N	168.0
33	14.9	N	6.3	1.5	3.8	0.204	2.1	N	5.3	N	N	168.0
67	75.7	N	5.6	1.4	3.6	0.188	1.9	0.9	5.3	N	N	210.0
10	270.0	N	15.9	1.4	4.3	0.323	3.4	2.0	3.5	N	N	136.7
67	34.7	N	9.4	0.6	5.9	0.215	4.3	N	1.8	N	N	101.7
33	37.0	N	10.3	1.7	5.0	0.079	2.4	1.5	3.2	N	N	146.7
37	31.0	N	8.5	1.7	4.7	0.101	2.3	1.6	2.9	N	N	140.0
67	159.7	N	10.9	2.2	4.3	0.169	5.9	N	4.3	N	N	130.7
67	138.4	N	15.2	2.5	4.5	0.187	5.0	N	3.8	N	N	173.3
56	543.3	N	9.4	1.4	7.3	0.308	10.5	1.6	3.3	N	N	120.0
51	121.7	N	3.8	0.4	5.7	0.206	7.1	0.7	2.4	N	N	180.0
17	399.3	N	7.9	1.6	8.1	0.283	10.2	N	1.7	N	N	136.3
10	636.7	N	9.9	1.6	6.9	0.314	11.5	1.2	3.1	N	N	130.0
10	319.3	N	6.2	1.4	8.9	0.150	10.7	N	1.9	N	N	128.0
00	160.0	N	3.5	1.7	7.3	0.062	5.9	0.6	3.6	N	N	96.3
33	186.7	N	1.7	1.7	7.0	0.061	6.6	0.4	4.5	N	N	120.0
33	200.8	N	3.0	1.3	6.3	0.131	6.4	N	2.7	N	N	106.7
33	201.6	N	2.6	1.3	5.8	0.153	5.5	N	2.8	N	N	106.7
23	773.3	N	4.1	6.7	19.3	0.304	21.4	N	37.1	N	N	453.3
67	411.6	N	11.2	6.3	18.4	0.371	37.1	N	16.1	N	N	425.1

STATE MUSSEL WATCH METALS

REG	STATION NAME	STA NUM	SAMPLE DATE	TYPE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
4	WEST BASIN	602.0	12JAN82	RBM	0.047	684.7	N	3.1	6.7	14.1	0.269	22.6	N	24.2	N	N	444.3
4	WEST BASIN	602.0	29DEC83	TCM	0.064	303.4	N	9.6	6.1	27.0	0.316	30.4	N	10.1	N	N	408.8
4	BIRTH 133	603.0	12JAN82	RBM	0.050	528.3	N	3.8	2.7	11.3	0.271	14.6	N	12.6	N	N	407.0
4	BERTH 133	603.0	29DEC83	TCM	0.084	319.5	N	8.8	4.4	22.5	0.435	30.0	N	13.0	N	N	430.4
4	GATE X	604.0	12JAN82	RBM	0.048	497.7	N	2.0	2.4	10.9	0.169	16.6	N	9.9	N	N	309.3
4	CABRILLO PIER	605.0	12JAN82	RBM	0.073	282.0	N	1.7	1.5	8.3	0.063	12.9	N	6.3	N	N	274.3
4	CABRILLO PIER	605.0	29DEC83	TCM	0.106	324.2	N	7.2	4.0	14.4	0.281	17.7	N	5.1	N	N	246.6
4	OUTER FISH HARBOR	606.0	12JAN82	RBM	0.033	438.0	N	1.0	2.0	12.1	0.180	17.3	N	11.4	N	N	298.7
4	TERMINAL ISLAND	607.0	12JAN82	TCM	0.493	185.7	N	2.5	1.4	5.5	0.044	11.6	N	5.4	N	N	99.0
4	TERMINAL ISLAND	607.0	12JAN82	RBM	0.653	267.7	N	2.1	9.7	9.6	0.054	13.5	N	6.5	N	N	194.3
4	TERMINAL ISLAND	607.0	29DEC83	TCM	0.361	389.2	N	3.9	3.3	9.0	0.142	14.9	N	5.3	N	N	166.4
4	NAVY MOLE	608.0	11DEC80	TCM	0.077	272.3	N	3.9	1.1	8.8	0.127	11.3	N	7.5	N	N	137.3
4	TIDE GAUGE	609.0	19MAY80	TCM	0.693	403.3	N	9.4	1.7	6.7	0.328	18.1	1.4	12.5	N	N	163.3
4	TIDE GAUGE	609.0	30MAR80	RBM	0.077	1502.0	N	3.6	1.6	7.7	0.398	30.3	2.1	23.6	N	N	220.0
4	TIDE GAUGE	609.0	12NOV80	TCM	0.513	326.3	N	3.9	1.3	8.7	0.136	16.1	N	5.8	N	N	110.7
4	TIDE GAUGE	609.0	12JAN82	TCM	0.430	247.7	N	3.5	1.4	6.9	0.041	9.6	N	8.2	N	N	140.3
4	TIDE GAUGE	609.0	12JAN82	RBM	0.045	293.3	6.5	0.8	1.0	7.2	0.023	13.8	N	4.2	0.9	N	149.7
4	TIDE GAUGE	609.0	29DEC83	TCM	0.359	385.2	N	3.4	2.2	9.5	0.199	18.4	N	11.0	N	N	175.6
4	PIER F	611.0	12JAN82	RBM	0.045	248.7	N	0.9	0.9	8.7	0.037	9.0	N	4.2	N	N	190.3
4	S.CAL. EDISON	613.0	12JAN82	RBM	0.037	410.7	N	1.4	1.7	11.9	0.158	19.3	N	7.8	N	N	317.0
4	S. CAL. EDISON	613.0	29DEC83	TCM	0.083	406.0	N	6.1	3.3	15.0	0.259	26.2	N	9.2	N	N	304.1
4	CHANNEL 3	614.0	12JAN82	RBM	0.047	260.7	N	1.7	1.7	16.6	0.091	20.6	N	14.6	N	N	304.0
4	HENRY FORD BRIDGE	615.0	12JAN82	RBM	0.163	409.3	N	2.2	4.5	19.1	0.224	15.8	N	8.0	N	N	244.3
4	CONSOLIDATED SLIP	616.0	12JAN82	TCM	0.107	282.0	N	9.8	4.3	12.0	0.224	20.7	N	33.1	N	N	452.0
4	CONSOLIDATED SLIP	616.0	12JAN82	RBM	0.060	474.7	11.9	4.6	7.8	14.3	0.224	19.7	N	34.9	0.8	N	388.0
4	WHITE'S POINT	617.0	12JAN82	TCM	2.400	18.7	N	3.5	1.3	6.2	0.031	3.7	N	3.2	N	N	101.7
4	POINT DUME	647.0	11DEC80	RCM	10.840	328.3	N	3.7	2.4	6.9	0.224	9.7	N	4.5	N	N	160.7
4	MALIBU	648.0	11DEC80	RCM	19.740	519.0	N	7.2	3.3	9.9	0.448	16.0	N	10.6	N	N	215.7
4	BIG ROCK BEACH	649.0	11DEC80	RCM	21.447	790.0	N	4.2	2.9	16.5	0.350	21.2	N	7.9	N	N	179.7
4	SANTA MONICA	650.0	11DEC80	RCM	12.517	492.7	N	2.7	2.3	15.9	0.345	15.6	N	5.4	N	N	144.3
4	MAR. DEL REY N DOCKS	651.0	19MAY80	TCM	0.165	333.3	N	8.8	1.1	18.6	0.183	19.4	1.0	46.3	N	N	306.7
4	MAR. DEL REY N DOCKS	651.0	14NOV80	TCM	0.257	339.7	N	6.4	1.7	26.8	0.186	16.2	N	33.7	N	N	263.0
4	M.D.R. N DOCKS JETTY	652.0	19MAY80	RBM	0.183	390.0	N	3.5	1.0	39.7	0.356	25.3	1.1	87.0	N	N	476.7
4	S. DOCKS JETTY	653.0	10JAN82	RBM	1.233	601.7	N	2.9	4.4	12.9	N	14.0	N	48.8	N	N	343.3
4	PLAYA DEL REY	654.0	11DEC80	RCM	27.627	380.0	N	1.9	3.3	19.8	0.299	13.1	N	31.3	N	N	214.0
4	EL SUSUNDO GRAND AVE	655.0	11DEC80	RCM	28.653	428.3	N	2.3	6.4	23.4	0.392	21.7	N	23.5	N	N	269.0
4	MANHATTAN BEACH	656.0	11DEC80	RCM	29.087	390.0	N	1.4	3.7	20.0	0.199	12.4	N	22.8	N	N	183.3
4	HERMOSA BEACH	657.0	11DEC80	RCM	26.153	272.7	N	1.4	2.7	20.9	0.247	9.7	N	28.3	N	N	200.0
4	REDONDO BEACH	658.0	11DEC80	RCM	28.653	279.0	N	2.1	2.6	13.1	0.303	8.3	N	17.8	N	N	196.3
4	PALOS VERDES POINT	659.0	15DEC80	RCM	42.000	89.0	N	4.3	2.8	17.0	0.330	5.9	N	4.1	N	N	200.7
4	POINT VICENTE	660.0	03NOV79	RCM	27.667	533.3	N	2.2	3.7	11.3	0.470	13.5	1.8	5.5	N	N	240.0
4	POINT VICENTE	660.0	11DEC80	RCM	33.613	190.3	N	1.7	3.3	15.0	0.239	12.9	N	2.8	N	N	181.0
4	ROYAL PALMS NORTH	661.0	03NOV79	RCM	42.333	320.0	N	4.0	7.5	27.0	0.978	8.6	2.9	8.1	N	N	336.7
4	ROYAL PALMS NORTH	661.0	14DEC80	RCM	67.300	360.3	N	5.9	8.1	24.7	0.748	13.2	N	9.1	N	N	238.0
4	ROYAL PALMS REGULAR	662.0	31JUL77	RCM	5.467	84.3	N	3.6	7.8	9.0	0.210	6.9	1.5	15.0	N	N	213.3
4	ROYAL PALMS REGULAR	662.0	05DEC77	RCM	6.700	150.0	N	2.6	6.7	10.5	0.248	8.6	2.2	17.7	N	N	280.0
4	ROYAL PALMS REGULAR	662.0	04AUG78	RCM	6.933	148.0	N	3.2	6.6	7.9	0.371	7.1	N	16.0	N	N	210.9

ZN
213.3
313.3
170.3
297.0
297.4
266.7
223.3
109.3
130.7
193.3
130.0
127.7
171.3
220.0
176.0
170.7
256.7
176.7
102.0
117.3
113.7
152.7
125.0
103.0
106.3
229.0
236.4
390.7
146.7
351.7
356.0
396.7
154.3
187.5
272.9
160.0
136.7
177.3
480.3
217.7
209.3
325.6
283.0
365.6
385.3
436.4
[illegible]

I	ZN
	597.3
	533.5
	150.0
	124.0
	128.7
	156.7
	156.7
	124.7
	169.0
	193.3
	226.7
	181.3
	216.0
	236.7
	270.0
	190.0
	90.0
	143.3
	112.0
	154.7
	113.3
	110.0
	112.7
	175.0
	246.3
	214.0
	99.0
	123.3
	120.0
	203.3
	230.0
	170.7
	181.3
	208.3
	180.0
	220.0
	190.3
	128.3
	133.0
	140.3
	97.7
	132.0
	160.0
	136.0
	203.7
	196.7
	284.1

STATE MUSSEL WATCH METALS

R E G	STATION NAME	STA NUM	SAMPLE DATE	TYPE	AG	AL	AS	CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
9	CORONADO HOTEL	841.0	13DEC80	RCM	1.697	433.0	N	1.6	1.1	7.9	0.134	10.2	N	3.2	N	N	142.7
9	IMPERIAL BEACH	842.0	13DEC80	RCM	2.000	656.7	N	1.8	1.2	8.5	0.108	17.8	N	2.4	N	N	120.7
9	PT LOMA A9 D	849.0	05JAN83	TCM	0.809	213.4	29.4	6.3	1.2	9.2	0.196	5.0	N	1.9	N	N	161.0
9	PT LOMA A9 S	849.0	05JAN83	TCM	0.602	137.7	N	5.9	1.3	8.4	0.179	4.0	N	2.4	N	N	160.2
9	PT.LOMA STP A-8	850.0	09JAN82	TCM	2.000	30.0	5.0	3.3	0.5	4.9	0.056	4.2	N	1.5	1.6	N	84.7
9	PT LOMA A8 D	850.0	26JAN83	RBM	0.347	474.1	N	5.7	1.7	10.4	0.179	6.2	N	1.7	N	N	161.5
9	PT LOMA A10 S	852.0	05JAN83	TCM	1.007	168.1	N	6.1	1.4	8.9	0.193	4.2	N	2.6	N	N	193.3
9	M.B.YACHT CLUB	864.0	28DEC83	TCM	0.083	613.8	N	5.1	1.5	10.3	0.253	12.3	N	4.7	N	N	205.8
9	M.B. HILTON DOCKS	865.0	09JAN82	RBM	0.045	825.3	N	2.1	1.0	8.8	0.082	25.7	N	5.3	N	N	156.3
9	M.B. HILTON DOCKS	865.0	28DEC83	TCM	0.144	1004.6	N	11.0	2.3	8.9	0.373	26.2	N	7.4	N	N	224.1
9	FISHERMAN CHANNEL	866.0	09JAN82	RBM	0.075	750.0	N	1.6	1.1	6.3	0.070	15.3	N	2.6	N	N	160.0
9	FISHERMAN CHANNEL	866.0	28DEC83	TCM	0.395	1153.6	N	11.4	2.7	10.4	0.381	18.7	N	7.9	N	N	286.1
9	INGRAHAM STREET	867.0	09JAN82	RBM	0.041	669.3	N	1.6	1.1	7.9	0.056	12.0	N	2.2	N	N	167.3
9	W.MISSION BAY DR.	868.0	09JUL82	RBM	0.043	688.7	N	1.1	1.3	6.6	0.039	9.9	N	2.4	N	N	182.7
9	M.B. SEAWORLD TWR.	869.0	28DEC83	TCM	0.206	996.4	N	7.1	2.2	10.5	0.263	19.1	N	6.2	N	N	264.0
9	M. B. SO.SHO.ROC 2	871.0	28DEC83	TCM	0.274	863.9	N	5.6	2.3	8.8	0.218	15.4	N	3.3	N	N	215.3
9	MISSION BAY	873.0	13NOV80	TCM	0.360	274.7	N	5.2	0.8	6.7	0.131	11.3	N	3.8	N	N	124.0
9	M. B.HARBOR POLICE	873.0	28DEC83	TCM	0.177	313.3	N	11.6	2.1	38.4	0.542	15.7	N	5.7	N	N	358.0
9	M.B. S.D. RIVER CH.	874.0	28DEC83	TCM	0.557	435.3	N	8.0	1.9	7.4	0.378	26.7	N	6.9	N	N	228.5
9	SWEETWATER MARSH	881.0	29DEC82	TCM	0.282	898.7	N	8.0	2.6	34.8	0.200	49.1	N	3.3	N	N	330.5
9	SD CAL CRANE	881.1	29DEC82	TCM	0.677	1024.7	N	8.0	2.5	17.1	0.178	31.9	N	2.9	N	N	295.4
9	24TH ST. MAR TERM S.	882.0	17JAN82	TCM	0.367	525.7	N	4.9	1.8	58.1	0.134	35.7	N	6.0	N	N	319.7
9	24TH ST. MAR TERM S.	882.0	29DEC82	TCM	0.363	911.5	17.0	11.1	2.6	60.3	0.236	62.9	N	5.6	N	N	336.4
9	24TH ST. MAR TERM S.	882.0	26OCT82	TCM	0.185	202.1	N	9.8	1.0	20.3	0.176	40.4	N	2.4	N	N	230.6
9	24TH ST. MAR TERM S.	882.0	26DEC82	TCM	0.291	170.1	N	7.5	1.3	37.1	0.156	28.0	N	3.4	N	N	287.0
9	24TH ST. MAR TERM S.	882.0	29DEC82	TCM	0.525	594.7	N	7.6	1.9	50.3	0.206	54.8	N	4.6	N	N	356.7
9	24TH ST. MAR TERM S.	882.0	04JAN84	TCM	0.435	916.7	N	9.0	2.7	78.7	0.301	34.2	N	6.4	N	N	354.3
9	PIER 13	882.4	29DEC82	TCM	5.195	655.3	N	9.5	1.9	32.7	0.227	73.4	N	3.9	N	N	379.1
9	PIER 13	882.4	04JAN84	TCM	0.311	613.6	N	6.4	2.7	31.8	0.278	26.2	N	6.0	N	N	332.2
9	NAVY AMPHIB. BASE	883.0	29DEC82	TCM	0.823	1010.3	N	8.9	2.1	16.5	0.231	20.9	N	2.9	N	N	264.2
9	GLORIETTA BAY	884.0	07JAN82	TCM	0.367	514.0	10.0	5.5	1.8	18.4	0.166	21.3	N	4.6	2.7	N	284.3
9	NASCO	886.0	29DEC82	TCM	0.271	541.6	N	7.2	1.9	37.7	0.192	42.5	N	7.6	N	N	348.5
9	EVENS STREET	887.0	07JAN82	TCM	0.237	358.3	N	8.6	2.1	29.8	0.207	33.4	N	9.3	N	N	355.7
9	EVANS STREET	887.0	29DEC82	TCM	0.293	567.0	N	7.6	2.3	48.3	0.249	50.8	N	8.1	N	N	427.1
9	EVANS STREET	887.0	26OCT82	TCM	0.171	291.9	N	5.9	1.4	21.3	0.182	42.4	N	4.7	N	N	272.5
9	CORONADO BRIDGE	888.0	16JUN80	TCM	0.423	706.7	N	11.9	1.8	12.1	0.241	45.1	1.2	9.0	N	N	310.0
9	CORONADO BRIDGE	888.0	16MAY80	RBM	0.103	840.0	N	4.7	1.7	11.0	0.206	22.0	0.6	6.6	N	N	240.0
9	CORONADO BRIDGE	888.0	13NOV80	TCM	0.273	462.0	N	10.2	2.1	16.1	0.313	50.4	N	7.7	N	N	279.3
9	8TH AVENUE	890.0	29DEC82	TCM	0.236	561.5	N	7.2	2.1	24.9	0.092	35.1	N	7.4	N	N	304.0
9	G STREET PIER	891.0	16MAY80	TCM	0.884	534.0	N	9.7	1.6	11.2	0.253	64.3	0.9	10.8	N	N	267.0
9	G STREET PIER	891.0	16MAY80	RBM	0.132	703.3	N	5.7	1.8	7.2	0.253	28.5	1.3	5.0	N	N	250.0
9	G STREET PIER	891.0	13NOV80	TCM	0.483	312.3	N	6.5	1.6	10.7	0.257	30.2	N	8.5	N	N	229.3
9	G STREET PIER	891.0	07JAN82	TCM	0.207	452.0	11.6	5.7	2.5	14.2	0.181	23.1	N	8.7	2.5	N	258.7
9	E BASIN STORM DRAIN	894.0	29DEC82	TCM	0.677	575.2	N	7.1	5.1	17.0	0.195	24.4	N	15.1	N	N	287.8
9	E BASIN STORM DRAIN	894.0	29DEC82	TCM	0.750	143.3	N	5.0	1.8	15.2	0.175	18.2	N	6.9	N	N	269.3
9	E. BASIN SOFT.BOT	894.1	04JAN84	TCM	0.608	356.2	N	11.8	6.0	15.3	0.443	14.0	N	9.9	N	N	368.3
9	E. BASIN DOCKS	894.5	04JAN84	TCM	0.501	504.3	N	10.9	4.0	21.9	0.357	20.2	N	23.1	N	N	292.6

METALS

CD	CR	CU	HG	MN	NI	PB	SE	TI	ZN
.8	1.9	16.6	0.119	35.8	N	7.9	N	N	276.3
.3	1.2	12.1	0.151	22.1	N	6.5	1.8	N	202.0
.1	1.9	14.2	0.224	23.9	N	6.0	N	N	239.2
.6	1.9	46.7	0.437	24.5	N	8.7	N	N	340.4
.4	1.1	82.1	0.449	27.9	N	13.7	N	N	489.0
.0	2.7	19.3	0.447	28.3	N	7.3	N	N	334.3
.8	2.2	13.1	0.385	16.7	N	8.4	N	N	291.6
.5	1.3	9.2	0.201	28.4	0.9	6.4	N	N	192.3
.4	1.4	7.7	0.223	11.4	1.2	3.9	N	N	220.0
.9	1.1	9.4	0.215	14.3	N	3.0	N	N	166.7
.3	0.9	7.3	0.060	6.6	N	4.4	1.8	N	114.3
.1	1.8	10.2	0.105	11.0	N	3.5	N	N	197.2
.3	0.8	9.3	0.204	10.0	N	2.7	N	N	145.0
.6	2.0	9.8	0.247	7.8	N	3.3	N	N	200.4
.9	1.7	8.6	0.151	11.8	N	3.4	N	N	196.0
.6	1.7	7.7	0.222	8.6	N	1.8	N	N	161.5

APPENDIX B

SUMMARY OF DATA

SYNTHETIC ORGANIC SUBSTANCES 1977-1984

(ng/g Dry Weight)

CODE	SPECIES SAMPLED
BNC =	Bentnose Clam
FWC =	Freshwater Clam
OYS =	Oyster
RBM =	Resident Bay Mussel
RCM =	Resident Califonia Mussel
TBM =	Transplanted Bay Mussel
TCM =	Transplanted California Mussel

Key	
D=	Not Detected
N=	Not Analyzed

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
1	2.00	CRESCENT CITY STP	22MAR83	RCM	D	D	D	D	D	3.30	D	D	3.60	6.90	D
1	2.00	CRESCENT CITY STP	20SEP83	RCM	D	D	D	24.00	D	20.00	2.50	D	D	46.50	D
1	3.00	CRESCENT CITY CONT.	22MAR83	RCM	D	D	D	D	D	D	D	D	1.10	1.10	D
1	3.00	CRESCENT CITY CONT.	20SEP83	RCM	D	D	D	1.10	D	D	D	D	D	1.10	D
1	5.00	REDWOODS NORTH	08NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	5.00	REDWOODS NORTH	24JUL78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	5.00	REDWOODS NORTH	19NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	7.00	REDWOODS SOUTH	06JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	10.00	TRINIDAD HEAD	07JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	10.00	TRINIDAD HEAD	09NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	10.00	TRINIDAD HEAD	24JUL78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	10.00	TRINIDAD HEAD	19NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	10.00	TRINIDAD HEAD	05OCT79	RCM	D	D	N	2.60	N	3.00	D	N	0.77	6.37	D
1	10.00	TRINIDAD HEAD	12JAN81	RCM	D	D	N	5.70	N	2.20	D	N	1.30	9.20	D
1	10.00	TRINIDAD HEAD	12JAN82	RCM	D	N	D	1.90	N	D	D	D	D	1.90	D
1	10.00	TRINIDAD HEAD	16SEP82	RCM	D	D	D	D	D	D	D	D	D	D	D
1	10.00	TRINIDAD HEAD	21SEP83	RCM	D	D	D	1.20	D	D	D	D	D	1.20	D
1	100.00	MAD RIVER SLOUGH	16DEC82	TCM	D	D	D	3.30	D	1.60	D	1.10	1.10	7.10	D
1	100.00	MAD RIVER SLOUGH	15FEB84	TCM	D	D	D	2.70	D	1.80	D	D	D	4.50	D
1	100.50	ARCATA DOCK	15FEB84	TCM	D	D	D	3.70	D	2.50	D	D	D	6.20	D
1	100.60	MAD RIVER OYSTER BED	14MAR84	OYS	N	N	N	N	N	N	N	N	N	N	N
1	101.00	SAMOA BRIDGE WEST	08MAY80	TCM	D	D	N	7.60	N	8.10	D	N	5.00	20.70	D

REG	STATION NUMBER	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
1	2.00	D	D	D	D	30.00	D	D	D	4.40	34.40	3.90	1.10	N	N	1.1
1	2.00	D	D	7.40	D	71.00	D	D	D	D	78.40	11.00	D	D	D	D
1	3.00	D	D	D	D	6.20	D	D	D	D	6.20	7.00	D	N	N	D
1	3.00	D	D	D	D	D	D	D	D	D	D	3.10	D	D	D	D
1	5.00	N	0.21	1.20	N	6.00	N	N	0.22	1.50	9.13	N	N	N	N	N
1	5.00	N	1.10	1.40	N	3.00	N	N	D	D	5.50	N	N	N	N	N
1	5.00	N	D	D	N	4.00	N	N	D	D	4.00	N	N	N	N	N
1	7.00	N	0.53	1.60	N	3.00	N	N	0.53	1.10	6.76	N	N	N	N	N
1	10.00	N	1.60	1.80	N	7.00	N	N	0.29	0.67	11.35	N	N	N	N	N
1	10.00	N	0.35	1.80	N	9.00	N	N	0.20	1.70	13.05	N	N	N	N	N
1	10.00	N	D	1.20	N	4.00	N	N	D	D	5.20	N	N	N	N	N
1	10.00	N	D	1.90	N	6.00	N	N	0.90	D	8.80	N	N	N	N	N
1	10.00	D	D	D	D	7.60	D	D	D	D	7.60	2.60	D	N	N	D
1	10.00	D	D	D	D	13.00	D	D	D	D	13.00	7.30	2.30	N	N	2.3
1	10.00	D	D	D	D	5.10	D	D	D	D	5.10	2.10	D	N	N	D
1	10.00	D	D	D	D	5.10	D	D	D	D	5.10	2.70	D	N	N	D
1	10.00	D	D	D	D	3.20	D	D	D	D	3.20	3.30	D	N	N	D
1	100.00	D	D	D	D	4.30	D	D	D	D	4.30	9.20	D	N	N	D
1	100.00	D	D	D	D	2.60	D	D	D	D	2.80	5.80	D	N	N	D
1	100.50	D	D	D	D	16.00	D	D	D	D	16.00	7.40	D	N	N	D
1	100.60	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
1	101.00	D	D	D	D	40.00	D	D	D	D	40.00	14.00	D	N	N	D

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
1	2.00	D	D	2.30	D	1.20	D	D	32.00	D	32.0	N	N	D	D	D	D
1	2.00	D	D	6.10	D	5.60	1.40	1.40	80.00	D	80.0	N	N	D	D	D	D
1	3.00	D	D	8.90	20.00	D	D	D	D	D	D	N	N	D	D	D	D
1	3.00	D	D	5.60	D	1.20	D	D	D	D	D	N	N	D	D	D	D
1	5.00	N	N	N	N	N	N	N	5.00	N	5.0	N	N	N	N	N	N
1	5.00	N	N	N	N	N	N	N	12.00	N	12.0	N	N	N	N	N	N
1	5.00	N	N	N	N	N	N	N	6.00	N	6.0	N	N	N	N	N	N
1	7.00	N	N	N	N	N	N	N	2.00	N	2.0	N	N	N	N	N	N
1	10.00	N	N	N	N	N	N	N	15.00	N	15.0	N	N	N	N	N	N
1	10.00	N	N	N	N	N	N	N	15.00	N	15.0	N	N	N	N	N	N
1	10.00	N	N	N	N	N	N	N	8.30	N	8.3	N	N	N	N	N	N
1	10.00	N	N	N	N	N	N	N	8.00	N	8.0	N	N	N	N	N	N
1	10.00	D	0.14	19.00	14.00	1.20	D	D	D	D	D	N	N	D	D	D	D
1	10.00	D	1.00	18.00	D	1.20	D	D	16.00	D	16.0	N	N	D	D	D	D
1	10.00	D	D	8.20	D	D	D	D	D	D	D	N	N	D	D	D	D
1	10.00	D	D	8.90	D	D	D	D	D	D	D	N	N	D	D	D	D
1	10.00	D	D	13.00	D	1.20	D	D	D	D	D	N	N	D	D	D	D
1	100.00	D	D	7.40	D	1.40	D	D	29.00	D	29.0	85.00	D	D	D	D	D
1	100.00	D	D	4.40	D	1.50	D	1.00	D	D	D	960.00	93.00	D	D	D	D
1	100.50	D	D	5.20	D	1.60	D	D	D	D	D	120.00	23.00	D	D	D	D
1	100.60	N	N	N	N	N	N	N	N	N	N	22.00	D	N	N	N	N
1	101.00	D	0.63	7.10	D	43.00	0.54	D	180.00	D	180.0	N	N	D	4.70	D	D

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
1	101.00	SAMOA BRIDGE WEST	04NOV80	TCM	D	D	N	4.10	N	D	D	N	1.60	5.7	D
1	101.00	SAMOA BRIDGE WEST	12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
1	101.00	SAMOA BRIDGE WEST	16DEC82	TCM	D	D	D	D	D	D	D	2.20	2.20	4.4	D
1	101.00	SAMOA BRIDGE WEST	15FEB84	TCM	N	N	N	N	N	N	N	N	N	N	N
1	102.00	SAMOA BRIDGE EAST	26MAR79	RCM	N	N	N	N	N	N	N	N	N	N	N
1	102.00	SAMOA BRIDGE EAST	08MAY80	RCM	0.50	D	N	4.40	N	5.90	D	N	3.80	14.1	D
1	102.00	SAMOA BRIDGE EAST	04NOV80	TCM	D	D	N	1.90	N	1.20	D	N	1.00	4.1	D
1	102.00	SAMOA BRIDGE EAST	12JAN82	TCM	D	N	D	3.30	N	2.40	D	D	2.00	7.7	D
1	102.50	WOODLEY ISLAND	15FEB84	TCM	D	D	D	3.40	D	2.40	D	N	D	5.8	D
1	103.00	EUREKA CHANNEL	08MAY80	TCM	D	D	N	4.20	N	4.40	D	N	3.60	12.2	D
1	103.00	EUREKA CHANNEL	04NOV80	TCM	D	D	N	2.10	N	3.20	D	N	2.40	7.7	D
1	103.00	EUREKA CHANNEL	12JAN82	TCM	N	N	N	N	N	N	D	N	N	N	N
1	103.00	EUREKA CHANNEL	16DEC82	TCM	D	D	D	D	D	D	D	4.50	4.50	9.0	D
1	104.00	EUREKA STP 1	21SEP83	TCM	D	D	D	1.40	D	D	D	N	D	1.4	D
1	104.00	EUREKA STP 1	15FEB84	TCM	D	D	D	2.50	D	2.20	D	N	D	4.7	D
1	104.50	EUREKA STP CONTROL	15FEB84	TCM	D	D	D	1.40	D	D	D	N	D	1.4	D
1	105.00	HUMBOLDT BAY ENTRANC	08JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	105.00	HUMBOLDT BAY ENTRANC	10NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N
1	105.00	HUMBOLDT BAY ENTRANC	25JUL78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	105.00	HUMBOLDT BAY ENTRANC	19NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N
1	106.00	HUMBOLDT FIELDS LAND	12JAN82	TCM	D	N	D	1.70	N	1.60	D	D	1.40	4.7	D
1	130.00	SHELTER COVE	09JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N

REG	STATION NUMBER	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
1	101.00	D	D	15.00	D	6.30	6.50	D	D	D	27.80	5.40	D	N	N	D
1	101.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
1	101.00	D	D	5.10	D	9.90	D	D	D	16.00	31.00	5.60	D	N	N	D
1	101.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
1	102.00	N	5.20	5.80	N	7.00	N	N	4.50	1.60	24.10	N	N	N	N	N
1	102.00	D	D	5.20	D	15.00	1.70	D	1.90	D	24.20	10.00	D	N	N	D
1	102.00	D	D	4.50	D	4.80	D	D	D	D	9.30	D	D	N	N	D
1	102.00	D	D	4.00	D	8.50	D	D	D	D	12.50	4.70	D	N	N	D
1	102.50	D	D	D	D	8.40	D	D	D	D	8.40	4.70	D	N	N	D
1	103.00	D	D	D	D	17.00	D	D	2.40	5.00	24.40	7.00	D	N	N	D
1	103.00	D	D	3.00	D	11.00	D	D	D	D	14.00	4.10	D	N	N	D
1	103.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
1	103.00	D	D	29.00	D	16.00	D	D	57.00	200.00	302.00	9.70	D	N	N	D
1	104.00	D	D	D	D	4.60	D	D	D	D	4.60	2.00	D	N	N	D
1	104.00	D	D	D	D	4.40	D	D	D	D	4.40	4.10	D	N	N	D
1	104.50	D	D	D	D	3.80	D	D	D	D	3.80	3.40	D	N	N	D
1	105.00	N	1.00	1.00	N	3.00	N	N	1.00	1.10	7.10	N	N	N	N	N
1	105.00	N	0.96	0.96	N	5.00	N	N	0.96	1.10	8.98	N	N	N	N	N
1	105.00	N	1.70	3.60	N	3.00	N	N	D	0.40	9.70	N	N	N	N	N
1	105.00	N	D	3.70	N	9.00	N	N	2.70	D	15.40	N	N	N	N	N
1	106.00	D	D	D	D	19.00	D	D	D	D	19.00	5.90	D	N	N	D
1	130.00	N	1.00	2.20	N	16.00	N	N	0.45	5.70	25.35	N	N	N	N	N

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
1	101.00	D	1.00	5.00	D	2.10	D	D	26.00	D	26	N	N	D	D	D	D
1	101.00	N	N	N	N	N	N	N	29.00	D	29	N	N	N	N	N	N
1	101.00	D	2.90	12.00	D	2.80	D	D	D	D	D	8.00	D	N	D	D	D
1	101.00	N	N	N	N	N	N	N	N	N	N	380.00	38.00	N	N	N	N
1	102.00	N	N	N	N	N	N	N	50.00	N	50	N	N	N	N	N	N
1	102.00	D	0.32	1.70	D	1.70	0.50	D	98.00	D	98	N	N	D	5.00	D	D
1	102.00	D	1.00	2.70	D	1.90	D	D	34.00	D	34	N	N	D	D	D	D
1	102.00	D	1.10	4.60	D	1.20	D	D	D	D	D	N	N	D	D	D	D
1	102.50	D	D	4.00	D	1.30	D	D	64.00	D	64	140.00	18.00	D	D	D	D
1	103.00	D	0.25	2.00	D	1.50	D	D	130.00	D	130	N	N	D	D	D	D
1	103.00	D	1.00	5.20	D	1.70	D	D	65.00	D	65	N	N	D	D	D	D
1	103.00	N	N	N	N	N	N	N	D	D	D	N	N	N	N	N	N
1	103.00	D	D	8.40	D	1.90	D	D	D	D	D	4.50	D	D	D	D	D
1	104.00	D	D	5.50	D	1.00	D	D	D	D	D	N	N	D	D	D	D
1	104.00	D	D	5.80	D	2.20	D	D	D	D	D	N	N	D	D	D	D
1	104.50	D	D	4.70	D	1.40	D	D	D	D	D	4.60	D	D	D	D	D
1	105.00	N	N	N	N	N	N	N	20.00	N	20	N	N	N	N	N	N
1	105.00	N	N	N	N	N	N	N	13.00	N	13	N	N	N	N	N	N
1	105.00	N	N	N	N	N	N	N	11.00	N	11	N	N	N	N	N	N
1	105.00	N	N	N	N	N	N	N	24.00	N	24	N	N	N	N	N	N
1	106.00	D	D	2.60	D	1.60	D	D	D	D	D	N	N	D	D	D	D
1	130.00	N	N	N	N	N	N	N	27.00	N	27	N	N	N	N	N	N

CS

TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
2.50	D	N	1.40	9.0	D	D
3.60	1.30	N	2.10	15.0	D	D
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
3.20	D	N	0.50	12.6	D	D
6.60	D	N	D	16.6	D	D
2.40	D	N	1.90	8.7	D	D
D	1.10	N	D	6.5	D	D
N	N	N	N	N	N	N

	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN
2	N	N	N	N	N	N
0	N	N	N	N	N	N
0	N	N	N	N	N	N
	N	N	N	N	N	N
	N	N	N	N	N	N
	N	N	N	N	N	N
6	N	N	N	N	N	N
8	N	N	N	N	N	N
0	N	N	N	N	N	N
0	N	N	N	N	N	N
5	8.70	D	N	N	D	16.00
0	8.30	2.00	N	N	2.0	D
	N	N	N	N	N	N
4	N	N	N	N	N	N
4	N	N	N	N	N	N
0	N	N	N	N	N	N
0	N	N	N	N	N	N
0	5.50	D	N	N	D	D
0	20.00	D	N	N	D	D
0	11.00	D	N	N	D	D
0	5.90	D	N	N	D	D
1	N	N	N	N	N	N

CTAL CB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
3	N	N	N	N	N	N
5	N	N	N	N	N	N
6	N	N	N	N	N	N
53	N	N	N	N	N	N
93	N	N	N	N	N	N
21	N	N	N	N	N	N
23	N	N	N	N	N	N
19	N	N	N	N	N	N
17	N	N	N	N	N	N
9	N	N	N	N	N	N
D	N	N	D	D	D	D
48	N	N	D	D	D	D
0	N	N	N	N	N	N
26	N	N	N	N	N	N
21	N	N	N	N	N	N
15	N	N	N	N	N	N
27	N	N	N	N	N	N
D	N	N	D	D	D	D
0	N	N	D	D	D	D
38	N	N	D	D	D	D
10	N	N	D	D	D	D
23	N	N	N	N	N	N

CH - ORGANICS

IS LOR ANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
11.00	N	4.90	2.40	N	3.80	22.10	D	D
6.00	N	1.50	D	D	1.50	9.00	D	D
7.50	N	D	D	D	1.70	9.20	D	D
6.80	N	1.00	1.10	D	1.70	10.60	D	D
D	D	D	D	D	2.20	2.20	D	D
N	N	N	N	N	N	N	N	N
2.00	N	1.90	D	N	2.90	6.80	D	D
1.90	N	1.30	1.20	N	1.20	5.60	D	D
4.40	N	3.00	D	D	3.00	10.40	D	D
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
3.50	N	2.40	D	N	2.10	8.00	D	D
5.50	N	D	D	N	2.60	8.10	D	D
6.00	D	19.00	1.20	D	19.00	65.20	D	5.00
3.00	N	16.00	2.00	N	18.00	69.00	N	N
1.00	N	12.00	3.00	D	11.00	47.00	D	D
3.00	1.30	15.00	1.00	D	14.00	55.50	D	3.40

DT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN
	D	N	N	N	N	N	N
	12.90	N	N	N	N	N	N
	20.90	N	N	N	N	N	N
	31.20	14.00	2.40	N	N	2.4	D
	14.00	9.30	D	N	N	D	D
	108.30	11.00	D	N	N	D	D
	22.60	10.00	D	N	N	D	D
	14.00	12.00	D	N	N	D	D
	34.70	N	N	N	N	N	N
	44.10	D	3.00	N	N	3.0	16.00
	31.00	4.70	D	N	N	D	D
	26.00	2.20	D	N	N	D	D
	18.00	N	N	N	N	N	N
55	20.35	N	N	N	N	N	N
30	69.30	N	N	N	N	N	N
	37.50	N	N	N	N	N	N
	9.60	5.40	1.70	N	N	1.7	D
	31.00	10.00	D	N	N	D	D
60	238.30	28.00	D	N	N	D	D
	N	24.00	N	N	N	N	N
	113.30	8.50	D	N	N	D	D
80	185.70	27.00	2.10	N	N	2.1	D

PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
N	16.0	N	N	N	N	N	N
N	19.0	N	N	N	N	N	N
N	15.0	N	N	N	N	N	N
D	52.0	N	N	D	D	D	D
D	D	N	N	D	D	D	D
D	D	N	N	D	D	D	D
D	D	N	N	D	D	D	D
D	D	N	N	D	D	D	D
N	52.0	N	N	N	N	N	N
D	77.0	N	N	D	3.60	D	D
D	27.0	N	N	D	D	D	D
D	D	N	N	D	D	D	D
N	41.0	N	N	N	N	N	N
N	39.0	N	N	N	N	N	N
N	13.0	N	N	N	N	N	N
N	59.0	N	N	N	N	N	N
D	30.0	N	N	D	1.60	D	D
D	93.0	N	N	D	D	D	D
D	230.0	N	N	D	D	D	D
D	690.0	N	N	N	N	N	N
D	140.0	N	N	D	D	D	D
D	330.0	N	N	D	D	D	D

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
2	302.00	POINT PINOLE	14DEC83	TCM	D	D	D	18.00	D	12.00	D	N	9.50	39.50	D	D
2	303.00	RICHMOND BRIDGE	04JUN80	TCM	D	D	N	12.00	N	15.00	D	N	8.60	35.60	D	D
2	303.00	RICHMOND BRIDGE	26JAN81	TCM	D	N	N	22.00	N	10.00	3.30	N	17.00	60.30	N	N
2	303.00	RICHMOND BRIDGE	02FEB82	TCM	D	D	N	24.00	N	8.60	2.40	D	11.00	46.00	D	2.60
2	303.00	RICHMOND BRIDGE	07DEC82	TCM	D	6.20	D	16.00	1.10	9.70	D	D	9.00	35.60	D	D
2	305.00	ANGEL ISLAND	04JUN80	TCM	D	D	N	73.00	N	63.00	D	N	100.00	236.00	D	11.00
2	305.00	ANGEL ISLAND	26JAN81	TCM	D	13.00	N	29.00	N	19.00	4.00	N	15.00	67.00	D	2.70
2	305.00	ANGEL ISLAND	07DEC82	TCM	D	D	D	20.00	D	12.00	D	D	8.30	40.30	D	3.90
2	306.00	FORT BAKER	27JAN81	TCM	D	N	N	19.00	N	11.00	2.40	N	8.70	41.10	N	N
2	306.00	FORT BAKER	07DEC82	TCM	D	D	D	14.00	D	8.20	D	D	7.60	29.80	D	D
2	307.00	TREASURE ISLAND	30MAR79	RSM	N	N	N	N	N	N	N	N	N	N	N	N
2	307.00	TREASURE ISLAND	04JUN80	TCM	D	D	N	23.00	N	22.00	D	N	16.00	61.00	D	D
2	307.00	TREASURE ISLAND	26JAN81	TCM	D	12.00	N	31.00	N	19.00	3.90	N	17.00	70.90	D	3.20
2	307.00	TREASURE ISLAND	02FEB82	TCM	D	D	N	21.00	N	12.00	N	4.70	10.00	47.70	D	D
2	307.00	TREASURE ISLAND	07DEC82	TCM	D	D	1.00	18.00	D	11.00	D	D	10.00	40.00	D	3.10
2	307.00	TREASURE ISLAND	14DEC83	TCM	D	D	D	9.60	D	11.00	D	N	8.30	28.90	D	D
2	308.00	HUNTER'S POINT	26JAN81	TCM	D	N	N	25.00	N	14.00	2.70	N	12.00	53.70	N	N
2	308.00	HUNTER'S POINT	18JAN82	TCM	D	9.40	N	8.30	N	6.70	1.70	D	5.40	22.10	D	D
2	308.00	HUNTER'S POINT	07DEC82	TCM	D	D	D	12.00	D	7.60	D	D	8.90	28.50	D	D
2	309.00	SAN MATEO BRIDGE 8	09FEB81	TCM	D	N	N	39.00	N	21.00	5.00	N	23.00	88.00	N	N
2	309.00	SAN MATEO BRIDGE 8	18JAN82	TCM	D	D	N	18.00	N	9.70	1.00	D	14.00	42.70	D	D
2	309.00	SAN MATEO BRIDGE 8	09DEC82	TCM	D	10.00	1.00	30.00	D	16.00	2.40	D	17.00	66.40	D	D

REG	STATION NUMBER	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN
2	302.00	6.50	61.00	D	64.00	D	D	D	D	131.5	40.00	D	D	D	D	D
2	303.00	D	D	2.90	56.00	D	D	3.10	8.00	70.0	18.00	D	N	N	D	D
2	303.00	N	N	N	N	N	N	N	N	N	26.00	N	N	N	N	N
2	303.00	15.00	93.00	2.00	63.00	11.00	13.00	5.90	11.00	213.9	21.00	D	N	N	D	D
2	303.00	12.00	80.00	D	50.00	5.50	14.00	4.30	10.00	175.8	31.00	D	N	N	D	D
2	305.00	53.00	190.00	60.00	1900.00	93.00	D	93.00	270.00	2659.0	29.00	D	N	N	D	D
2	305.00	25.00	100.00	4.90	71.00	11.00	29.00	6.60	11.00	258.5	34.00	2.50	N	N	2.5	D
2	305.00	10.00	120.00	D	48.00	5.00	15.00	3.10	12.00	213.1	40.00	D	N	N	D	D
2	306.00	N	N	N	N	N	N	N	N	N	20.00	N	N	N	N	N
2	306.00	9.40	35.00	D	38.00	8.20	D	3.20	7.10	100.9	29.00	D	N	N	D	D
2	307.00	19.00	65.00	N	56.00	N	N	16.00	24.00	180.0	N	N	N	N	N	N
2	307.00	11.00	72.00	14.00	72.00	D	D	4.20	20.00	193.2	32.00	1.60	N	N	1.6	D
2	307.00	22.00	110.00	4.20	69.00	15.00	26.00	6.00	13.00	265.2	24.00	1.20	N	N	1.2	D
2	307.00	8.10	58.00	5.30	41.00	9.50	D	D	D	121.9	11.00	D	N	N	D	D
2	307.00	13.00	64.00	4.60	41.00	5.60	D	3.10	8.80	140.1	41.00	D	N	N	D	D
2	307.00	6.60	44.00	D	51.00	D	D	D	D	101.6	43.00	2.50	D	D	2.5	D
2	308.00	N	N	N	N	N	N	N	N	N	27.00	N	N	N	N	N
2	308.00	D	27.00	D	31.00	6.70	D	D	4.90	69.6	54.00	D	N	N	D	D
2	308.00	7.70	55.00	D	46.00	D	D	D	4.80	113.5	62.00	1.50	N	N	1.5	D
2	309.00	N	N	N	N	N	N	N	N	N	50.00	N	N	N	N	N
2	309.00	3.30	28.00	3.80	30.00	D	D	D	D	65.1	32.00	D	N	N	D	D
2	309.00	10.00	55.00	D	55.00	D	D	D	5.20	126.2	100.00	5.20	N	N	5.2	D

REG	STATION NUMBER	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
2	302.00	D	2.60	D	1.50	D	D	180.00	D	180.0	N	N	D	D	D	D
2	303.00	0.63	1.80	6.10	D	D	D	370.00	D	370.0	N	N	D	D	D	D
2	303.00	N	N	N	N	N	N	1100.00	D	1100.0	N	N	N	N	N	N
2	303.00	1.60	3.60	D	2.80	D	D	220.00	D	220.0	N	N	D	D	73.00	D
2	303.00	2.90	4.40	D	2.90	D	1.00	280.00	D	280.0	N	N	D	D	D	D
2	305.00	D	1.50	7.10	1.20	1.40	5.30	770.00	D	770.0	N	N	D	D	D	73.00
2	305.00	1.20	7.80	D	4.80	1.10	D	830.00	D	830.0	N	N	D	D	D	D
2	305.00	2.30	5.00	D	3.10	D	0.90	230.00	D	230.0	N	N	D	D	D	D
2	306.00	N	N	N	N	N	N	510.00	D	510.0	N	N	N	N	N	N
2	306.00	2.10	5.50	D	2.80	D	D	270.00	D	270.0	N	N	D	D	D	D
2	307.00	N	N	N	N	N	N	790.00	N	790.0	N	N	N	N	N	N
2	307.00	0.54	1.60	D	1.80	0.16	2.00	630.00	D	630.0	N	N	D	1.20	D	D
2	307.00	1.00	4.50	D	3.70	0.90	D	1500.00	D	1500.0	N	N	D	D	D	D
2	307.00	1.70	3.00	D	1.90	D	D	220.00	D	220.0	N	N	D	D	D	D
2	307.00	0.60	4.90	D	3.60	D	D	300.00	D	300.0	N	N	D	D	D	D
2	307.00	D	1.70	D	2.10	D	D	280.00	D	280.0	N	N	D	D	D	D
2	308.00	N	N	N	N	N	N	1800.00	D	1800.0	N	N	N	N	N	N
2	308.00	1.10	3.90	D	2.30	D	D	230.00	D	230.0	N	N	D	D	D	D
2	308.00	0.50	0.70	D	0.60	D	0.90	340.00	D	340.0	N	N	D	D	D	D
2	309.00	N	N	N	N	N	N	1300.00	D	1300.0	N	N	N	N	N	N
2	309.00	1.50	3.40	D	3.10	D	D	180.00	D	180.0	N	N	D	D	D	D
2	309.00	1.60	5.40	D	4.80	D	3.40	430.00	D	430.0	N	N	D	D	D	D

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
2	309.00	SAN MATEO BRIDGE 8	14DEC83	TCM	D	D	D	18.00	D	10.00	D	N	12.00	40.00	D	D
2	310.00	SAN MATEO BRIDGE 8A	18JAN82	TCM	D	14.00	N	14.00	N	9.40	3.10	D	D	26.50	D	D
2	313.00	REDWOOD CREEK MOUTH	26JAN81	TCM	D	13.00	N	32.00	N	24.00	4.60	N	22.00	82.60	D	3.20
2	313.00	REDWOOD CREEK MOUTH	11JAN82	TCM	D	D	N	27.00	N	14.00	3.70	D	13.00	57.70	D	4.40
2	313.00	REDWOOD CREEK MOUTH	09DEC82	TCM	D	12.00	1.60	28.00	1.50	16.00	1.60	D	18.00	66.70	D	6.10
2	313.00	REDWOOD CREEK MOUTH	14DEC83	TCM	D	D	D	18.00	D	12.00	D	N	12.00	42.00	D	D
2	316.00	REDWOOD CRK TRDWNDS	04JUN80	RCM	1.20	D	N	56.00	N	50.00	D	N	70.00	176.00	D	15.00
2	321.00	DUMBARTON BRIDGE 14	09FEB81	TCM	D	D	N	46.00	N	23.00	5.10	N	28.00	102.10	D	9.20
2	321.00	DUMBARTON BRIDGE 14	18JAN82	TCM	D	14.00	N	8.20	N	7.40	2.80	D	14.00	32.40	D	2.60
2	321.00	DUMBARTON BRIDGE 14	14DEC83	TCM	D	D	D	33.00	D	19.00	2.80	N	15.00	69.80	D	D
2	330.00	DUXBURY REEF	29DEC79	RCM	D	D	N	7.60	N	5.80	D	N	1.30	14.70	D	D
2	330.00	DUXBURY REEF	16FEB81	RCM	D	D	N	12.00	N	6.40	2.20	N	4.80	25.40	D	D
2	333.00	FARALLON ISLANDS	15JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	333.00	FARALLON ISLANDS	20NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	333.00	FARALLON ISLANDS	20AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	333.00	FARALLON ISLANDS	28OCT78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	336.00	J. FITZGERALD	16JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	336.00	J. FITZGERALD	19NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	336.00	J. FITZGERALD	30AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	336.00	J. FITZGERALD	24NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
2	336.00	J. FITZGERALD	09OCT79	RCM	D	D	N	6.00	N	1.40	D	N	0.76	8.16	D	D
2	336.00	J. FITZGERALD	16FEB81	RCM	D	D	N	14.00	N	3.60	1.80	N	3.00	22.40	D	D

REG	STATION NUMBER	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
2	309.00	D	17.00	D	38.00	D	D	D	D	55.0	82.00	5.20	D	D	5.2
2	310.00	D	12.00	D	20.00	D	D	D	D	32.0	18.00	D	N	N	D
2	313.00	9.30	46.00	5.90	52.00	7.50	14.00	6.50	7.40	143.6	44.00	3.70	N	N	3.7
2	313.00	5.40	55.00	D	26.00	D	D	D	D	86.4	55.00	D	N	N	D
2	313.00	6.40	39.00	D	52.00	D	D	D	4.90	102.3	81.00	4.80	N	N	4.8
2	313.00	D	22.00	D	44.00	D	D	D	D	66.0	64.00	4.00	D	D	4.0
2	316.00	D	73.00	10.00	94.00	D	D	7.40	13.00	197.4	36.00	1.00	N	N	1.0
2	321.00	5.60	34.00	11.00	99.00	13.00	D	10.00	5.20	177.8	35.00	3.00	N	N	3.0
2	321.00	D	13.00	D	44.00	D	D	D	D	57.0	24.00	D	N	N	D
2	321.00	D	47.00	D	48.00	D	D	D	8.00	103.0	68.00	9.70	D	D	9.7
2	330.00	D	6.30	D	9.80	D	D	D	D	16.1	2.40	D	N	N	D
2	330.00	D	5.80	D	8.60	D	D	D	D	14.4	17.00	D	N	N	D
2	333.00	D	5.60	N	28.00	N	N	D	D	33.6	N	N	N	N	N
2	333.00	0.64	2.70	N	130.00	N	N	2.70	3.50	139.5	N	N	N	N	N
2	333.00	6.30	4.10	N	9.00	N	N	D	2.20	21.6	N	N	N	N	N
2	333.00	D	6.40	N	33.00	N	N	2.50	9.50	51.4	N	N	N	N	N
2	336.00	4.40	3.60	N	320.00	N	N	0.91	2.10	331.0	N	N	N	N	N
2	336.00	1.10	4.20	N	28.00	N	N	0.53	3.90	37.7	N	N	N	N	N
2	336.00	7.50	3.30	N	6.60	N	N	D	D	17.4	N	N	N	N	N
2	336.00	D	10.00	N	10.60	N	N	D	D	20.6	N	N	N	N	N
2	336.00	D	D	D	8.80	D	D	D	D	8.8	4.20	D	N	N	D
2	336.00	D	D	D	14.00	D	D	D	D	14.0	7.90	D	N	N	D

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
2	309.00	D	D	2.50	D	20.00	D	D	180.00	D	180.0	N	N	D	D	D	D
2	310.00	D	1.00	4.70	D	2.40	D	D	140.00	D	140.0	N	N	D	D	D	D
2	313.00	D	0.90	3.20	12.00	5.00	1.20	D	1200.00	D	1200.0	N	N	D	D	D	D
2	313.00	D	1.50	4.40	D	4.80	D	D	200.00	D	200.0	N	N	D	D	D	D
2	313.00	D	D	4.10	D	4.30	D	2.70	390.00	D	390.0	N	N	D	D	D	D
2	313.00	D	D	2.20	D	6.20	D	D	210.00	D	210.0	N	N	D	D	D	D
2	316.00	D	0.73	2.70	6.80	2.20	0.68	7.40	850.00	D	850.0	N	N	D	D	D	D
2	321.00	D	1.00	4.00	D	13.00	2.10	D	1300.00	D	1300.0	N	N	D	D	D	D
2	321.00	D	1.00	5.20	D	6.60	D	D	250.00	D	250.0	N	N	D	D	D	D
2	321.00	D	D	2.90	D	3.90	D	3.30	180.00	D	180.0	N	N	D	D	D	D
2	330.00	D	0.19	9.30	7.80	1.60	D	D	62.00	D	62.0	N	N	D	D	D	D
2	330.00	D	D	8.00	2.20	1.10	D	D	58.00	D	58.0	N	N	D	D	D	D
2	333.00	N	N	N	N	N	N	N	80.00	N	80.0	N	N	N	N	N	N
2	333.00	N	N	N	N	N	N	N	76.00	N	76.0	N	N	N	N	N	N
2	333.00	N	N	N	N	N	N	N	28.00	N	28.0	N	N	N	N	N	N
2	333.00	N	N	N	N	N	N	N	55.00	N	55.0	N	N	N	N	N	N
2	336.00	N	N	N	N	N	N	N	65.00	N	65.0	N	N	N	N	N	N
2	336.00	N	N	N	N	N	N	N	93.00	N	93.0	N	N	N	N	N	N
2	336.00	N	N	N	N	N	N	N	9.40	N	9.4	N	N	N	N	N	N
2	336.00	N	N	N	N	N	N	N	15.00	N	15.0	N	N	N	N	N	N
2	336.00	D	0.27	6.40	8.20	0.79	D	D	D	D	D	N	N	D	D	D	D
2	336.00	D	1.00	10.00	8.60	9.20	D	D	35.00	D	35.0	N	N	D	D	D	D

STATE MUSSEL WATCH - ORGANICS

TION	SAMPLE DATE	TYPE	ALDRIN	CHLORDENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE	OXY CHLORDANE	CIS NONACHLOR	TRANS NONACHLOR	TOTAL CHLORDANE	CHLORPYRIFOS	DACTHAL
NUEVO	18NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NUEVO	15AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NUEVO	04JAN79	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NUEVO	17OCT82	RCM	D	D	D	4.40	D	2.20	3.80	D	25.00	35.40	D	D
TA CRUZ HARBOR	29MAY80	TCM	D	D	N	20.00	N	13.00	D	N	14.00	47.00	D	D
TA CRUZ HARBOR	24NOV80	TCM	D	D	N	29.00	N	15.00	3.10	N	10.00	57.10	D	D
SONVILLE SLOUGH	17NOV82	TCM	N	N	N	N	N	N	N	N	N	N	N	N
SONVILLE SLOUGH	29NOV83	TCM	D	17.00	3.20	63.00	4.60	44.00	D	N	D	114.80	D	830.00
YACHT HARBOR	29NOV83	RBM	D	18.00	4.10	120.00	5.40	65.00	D	N	D	194.50	D	2200.00
BY PARK	17NOV82	TCM	N	N	N	N	N	N	N	N	N	N	N	N
BY PARK	23NOV83	TCM	D	7.30	D	25.00	D	16.00	D	N	D	41.00	D	160.00
DUCK CLUB	24FEB82	RBM	D	D	N	29.00	N	12.00	4.30	D	13.00	50.30	D	41.00
SON'S SLOUGH	27NOV82	TCM	N	N	N	N	N	N	N	N	N	N	N	N
SON'S SLOUGH	23NOV83	TCM	D	5.30	D	15.00	D	5.60	D	N	D	20.60	D	240.00
FIC MARICULTURE	26MAR79	RBM	N	N	N	N	N	N	N	N	N	N	N	N
FIC MARICULTURE	13FEB81	RBM	D	D	N	5.20	N	11.00	4.20	N	13.00	33.40	D	150.00
FIC MARICULTURE	07FEB84	OYS	D	D	D	9.10	D	6.20	D	N	D	15.30	D	D
. FGSE	27NOV82	TCM	N	N	N	N	N	N	N	N	N	N	N	N
. SKIPPERS	02FEB84	BNC	D	D	D	4.60	D	2.60	D	N	1.50	8.70	D	3.70
. SKIPPERS	02FEB84	LNC	D	D	D	3.80	D	D	D	D	1.90	5.70	D	3.80
. HIGHWAY BRIDGE	29MAY80	TCM	D	D	N	6.00	N	6.00	D	N	2.10	14.10	D	12.00
. HIGHWAY BRIDGE	24NOV80	TCM	D	D	N	1.30	N	4.40	1.80	N	3.40	10.90	D	2.90

DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
.10	16.00	N	590.00	N	N	1.20	3.80	617.1	N	N	N	N	N
.00	50.00	N	430.00	N	N	D	8.50	502.5	N	N	N	N	N
.10	34.00	N	880.00	N	N	3.20	11.00	930.3	N	N	N	N	N
)	25.00	D	507.00	9.90	D	D	D	541.9	13.00	14.00	N	N	14.0
)	D	D	49.00	D	D	4.20	12.00	65.2	12.00	3.00	N	N	3.0
.20	50.00	D	55.00	6.10	D	D	4.50	123.8	11.00	26.00	N	N	26.0
.00	430.00	18.00	880.00	35.00	D	37.00	120.00	1615.0	N	400.00	N	N	400.0
.00	760.00	32.00	1600.00	32.00	D	70.00	540.00	3244.0	240.00	1800.00	770.00	820.00	3390.0
.00	620.00	34.00	1800.00	45.00	D	180.00	830.00	3719.0	280.00	4700.00	3400.00	2500.00	10600.0
.00	170.00	8.70	430.00	16.00	D	6.90	34.00	702.6	N	430.00	N	N	430.0
.00	210.00	16.00	700.00	16.00	D	29.00	140.00	1154.0	160.00	650.00	340.00	840.00	1830.0
.00	140.00	13.00	450.00	12.00	D	57.00	330.00	1048.0	46.00	260.00	N	N	260.0
.00	120.00	12.00	240.00	17.00	D	32.00	140.00	604.0	N	290.00	N	N	290.0
.00	82.00	5.50	220.00	10.00	D	16.00	72.00	432.5	84.00	770.00	400.00	530.00	1700.0
.00	180.00	N	37.00	N	N	D	170.00	423.3	N	N	N	N	N
.00	160.00	D	280.00	18.00	19.00	36.00	140.00	694.0	29.00	170.00	N	N	170.0
.00	81.00	7.70	620.00	D	D	16.00	160.00	907.7	5.80	53.00	13.00	19.00	85.0
.00	170.00	9.00	260.00	12.00	D	32.00	190.00	716.0	N	250.00	N	N	250.0
)	27.00	D	220.00	D	D	D	25.00	272.0	6.60	40.00	43.00	55.00	138.0
)	12.00	D	96.00	D	D	D	34.00	142.0	3.60	54.00	31.00	38.00	123.0
.60	15.00	1.10	160.00	D	D	3.10	44.00	251.8	31.00	24.00	N	N	24.0
.10	32.00	D	96.00	5.00	D	3.00	12.00	156.1	21.00	140.00	N	N	140.0

RIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
N	N	N	N	N	N	N	330.00	N	330	N	N	N	N	N	N
N	N	N	N	N	N	N	180.00	N	180	N	N	N	N	N	N
N	N	N	N	N	N	N	370.00	N	370	N	N	N	N	N	N
D	D	1.40	D	D	D	1.40	360.00	D	360	N	N	D	D	D	D
D	D	D	D	D	D	D	110.00	D	110	N	N	17.00	D	D	D
D	1.00	6.20	3.00	3.50	D	D	150.00	D	150	N	N	D	D	D	D
N	N	N	N	N	N	N	N	N	N	N	N	N	N	950.00	N
.00	D	6.60	D	6.30	D	5.70	87.00	D	87	N	N	D	D	1300.00	D
.00	1.60	3.70	D	2.00	D	16.00	350.00	D	350	N	N	D	D	1500.00	D
N	N	N	N	N	N	N	N	N	N	N	N	N	N	320.00	N
.00	D	3.10	D	2.80	D	9.20	79.00	D	79	N	N	D	D	400.00	D
.10	0.94	2.90	D	0.85	D	D	91.00	D	91	N	N	D	D	520.00	D
N	N	N	N	N	N	N	N	N	N	N	N	N	N	940.00	N
.00	D	3.30	D	1.70	D	3.20	67.00	D	67	N	N	D	D	200.00	D
N	N	N	N	N	N	N	180.00	N	180	N	N	N	N	N	N
D	1.00	3.80	2.40	1.20	D	D	210.00	D	210	N	N	D	D	D	D
D	D	1.70	D	D	D	D	160.00	D	160	N	N	D	D	370.00	D
N	N	N	N	N	N	N	N	N	N	N	N	N	N	640.00	N
D	D	1.90	D	6.80	D	D	83.00	D	83	N	N	D	D	200.00	D
D	D	3.90	D	2.10	D	D	64.00	D	64	N	N	D	D	250.00	D
D	0.10	4.20	7.10	0.80	0.15	D	65.00	D	65	N	N	D	1.80	D	D
D	1.00	6.30	2.40	D	D	D	100.00	D	100	N	N	D	D	D	D

TRANS CHLORDANE	OXY CHLORDANE	CIS NONACHLOR	TRANS NONACHLOR	TOTAL CHLORDANE	CHLORPYRIFOS	DACTHAL
N	N	N	N	N	N	N
120.00	6.30	D	89.00	335.30	D	140.00
N	N	N	N	N	N	N
N	N	N	N	N	N	N
55.00	D	N	D	159.20	18.00	1200.00
230.00	D	D	D	659.00	500.00	8600.00
61.00	D	D	D	252.80	260.00	6700.00
88.00	D	D	D	254.00	240.00	4300.00
56.00	D	N	D	149.00	D	D
2.20	D	D	D	7.10	D	2.10
3.20	D	D	1.60	7.80	D	D
4.10	D	D	1.40	18.50	D	2.20
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
N	N	N	N	N	N	N
5.20	1.70	N	4.10	28.00	D	2.70
4.80	D	D	1.60	16.40	D	2.20
5.50	D	N	D	13.40	D	D
5.30	D	D	3.90	20.20	D	1.80
15.00	D	N	5.10	36.10	D	D
5.00	D	D	4.00	21.00	D	2.90

DIELDRIN	ENDOSULFAN I	ENDOSULFAN II	ENDOSULFAN SULFATE	TOTAL ENDOSULFAN
N	1500.00	N	N	1500.0
180.00	770.00	N	N	770.0
N	530.00	N	N	530.0
N	1200.00	N	N	1200.0
360.00	3500.00	1800.00	1900.00	7200.0
1500.00	9600.00	8500.00	6400.00	24500.0
450.00	4200.00	3000.00	3300.00	10500.0
150.00	220.00	180.00	320.00	720.0
14.00	260.00	270.00	150.00	680.0
7.50	6.70	N	N	6.7
6.90	5.50	N	N	5.5
8.30	9.50	N	N	9.5
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
4.80	8.40	N	N	8.4
20.00	13.00	N	N	13.0
18.00	41.00	N	N	41.0
4.10	8.20	N	N	8.2
2.90	7.30	N	N	7.3
9.40	8.20	N	N	8.2

PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARATHION	RONNEL	TOXAPHENE	TEDION
N	N	N	N	4500.00	N
N	N	D	D	2200.00	D
N	N	N	N	1100.00	N
N	N	N	N	4500.00	N
N	N	D	D	1300.00	D
N	N	D	D	22000.00	D
N	N	D	D	7600.00	D
N	N	D	D	8100.00	D
N	N	D	D	7700.00	D
N	N	D	D	D	D
N	N	D	D	D	D
N	N	D	D	D	D
N	N	N	N	N	N
N	N	N	N	N	N
N	N	N	N	N	N
N	N	N	N	N	N
N	N	D	D	D	D
N	N	D	D	D	D
N	N	D	D	D	D
N	N	D	D	D	D
N	N	D	D	D	D
N	N	D	D	D	D

STATE MUSSEL-WATCH - ORGANICS

TION E	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
TY S.ROCKS	30DEC82	RCM	D	4.00	D	17.00	D	12.00	D	D	9.00	38.00	D	3.00
AY	18JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
AY	19AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
AY	13DEC78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
AY	04OCT82	RCM	D	D	D	6.10	D	1.90	D	D	1.50	9.50	D	2.10
ONTROL	29NOV83	TCM	D	D	D	4.70	D	2.60	D	N	D	7.30	D	D
TP N.	29NOV83	TCM	D	D	D	5.20	D	3.80	D	N	D	9.00	D	D
TP S.	29NOV83	TCM	D	D	D	6.60	D	4.50	D	N	D	11.10	D	D
S POINT	20JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
S POINT	22NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
S POINT	21JUL78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
S POINT	11DEC78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
S POINT	11JAN83	RCM	D	D	D	7.00	D	1.70	D	D	D	8.70	D	D
NS	20JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NS	10DEC77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NS	02AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NS	14NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
NS	04NOV79	RCM	D	D	N	5.60	N	1.80	D	N	0.98	8.38	D	D
NS	04OCT82	RCM	D	D	D	1.90	D	1.00	D	D	D	2.90	D	D
REEK	22JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
REEK	28NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
REEK	08JUL78	RCM	N	N	N	N	N	N	N	N	N	N	N	N

P'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN	ENDRIN
4.00	D	47.00	D	D	9.50	25.00	95.50	6.00	9.90	N	N	9.9	D
3.10	N	16.00	N	N	1.10	6.30	27.60	N	N	N	N	N	N
7.20	N	12.50	N	N	D	13.00	35.50	N	N	N	N	N	N
2.00	N	32.00	N	N	1.60	D	49.90	N	N	N	N	N	N
4.30	D	24.00	D	D	D	D	28.30	3.40	1.60	N	N	1.6	D
D	D	26.00	D	D	D	D	26.00	6.20	6.80	D	D	6.8	D
5.00	D	24.00	D	D	D	4.60	33.50	4.80	6.10	D	D	6.1	D
4.30	D	32.00	D	D	D	6.10	42.40	6.20	7.20	D	D	7.2	D
2.00	N	14.00	N	N	2.00	1.20	20.30	N	N	N	N	N	N
7.20	N	23.00	N	N	7.20	0.34	42.14	N	N	N	N	N	N
6.40	N	11.00	N	N	D	2.00	23.70	N	N	N	N	N	N
0.00	N	58.00	N	N	2.50	10.00	95.60	N	N	N	N	N	N
D	D	25.00	D	D	D	D	25.00	2.10	3.30	N	N	3.3	D
D	N	15.00	N	N	D	D	15.00	N	N	N	N	N	N
6.00	N	46.00	N	N	0.38	4.30	58.38	N	N	N	N	N	N
2.00	N	6.00	N	N	D	D	18.00	N	N	N	N	N	N
1.00	N	18.00	N	N	D	D	49.00	N	N	N	N	N	N
D	1.20	26.00	D	D	D	D	27.20	D	D	N	N	D	D
4.60	D	20.00	D	D	D	D	24.60	2.00	D	N	N	D	D
2.60	N	13.00	N	N	0.17	1.50	17.90	N	N	N	N	N	N
4.40	N	25.00	N	N	1.50	2.30	33.31	N	N	N	N	N	N
4.80	N	21.00	N	N	D	2.30	37.70	N	N	N	N	N	N

E	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
	5.00	D	D	D	D	D	D	D	N	N	D	D	D	D
	N	N	N	N	N	16.00	N	16	N	N	N	N	N	N
	N	N	N	N	N	29.00	N	29	N	N	N	N	N	N
	N	N	N	N	N	51.00	N	51	N	N	N	N	N	N
	0.90	D	D	D	D	D	D	D	N	N	D	D	D	D
	5.80	D	0.53	D	D	28.00	D	28	N	N	D	D	D	D
	6.60	D	0.59	D	D	29.00	D	29	N	N	D	D	D	D
	8.10	D	0.77	D	D	39.00	D	39	N	N	D	D	D	D
	N	N	N	N	N	18.00	N	18	N	N	N	N	N	N
	N	N	N	N	N	25.00	N	25	N	N	N	N	N	N
	N	N	N	N	N	22.00	N	22	N	N	N	N	N	N
	N	N	N	N	N	57.00	N	57	N	N	N	N	N	N
	3.60	D	D	D	D	D	D	D	N	N	D	D	D	D
	N	N	N	N	N	6.00	N	6	N	N	N	N	N	N
	N	N	N	N	N	27.00	N	27	N	N	N	N	N	N
	N	N	N	N	N	15.00	N	15	N	N	N	N	N	N
	N	N	N	N	N	13.00	N	13	N	N	N	N	N	N
	10.00	D	0.89	D	D	39.00	D	39	N	N	D	D	D	D
	1.20	D	D	D	D	D	D	D	N	N	D	D	D	D
	N	N	N	N	N	19.00	N	19	N	N	N	N	N	N
	N	N	N	N	N	18.00	N	18	N	N	N	N	N	N
	N	N	N	N	N	9.00	N	9	N	N	N	N	N	N

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR DENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
3	426.00	SALMON CREEK	14NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	427.00	MORRO BAY UPPER	30MAY80	RCM	D	D	N	2.40	N	D	D	N	2.40	4.8	D	D
3	427.00	MORRO BAY UPPER	14DEC80	TCM	D	D	N	8.10	N	3.30	1.30	N	2.10	14.8	D	2.20
3	428.50	MORRO BAY VIRG'S	30MAR79	RBM	N	N	N	N	N	N	N	N	N	N	N	N
3	428.50	MORRO BAY VIRG'S	30MAY80	RCM	D	D	N	2.80	N	3.00	D	N	5.70	11.5	D	D
3	428.50	MORRO BAY VIRG'S	14DEC80	TCM	D	D	N	5.70	N	4.00	1.00	N	2.70	13.4	D	D
3	430.00	MONTANA DE ORO	14DEC82	RCM	D	D	D	2.90	D	2.60	D	D	1.80	7.3	D	2.00
3	430.00	MONTANA DE ORO	05OCT83	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	430.00	MONTANA DE ORO	16FEB84	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	430.10	MONTANA DE ORO	23JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	430.10	MONTANA DE ORO	29NOV77	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	430.10	MONTANA DE ORO	01AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	430.10	MONTANA DE ORO	15NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	433.00	N. DIABLO COVE	14DEC82	RCM	D	D	D	1.50	D	1.00	D	D	1.00	3.5	D	1.80
3	434.00	S. DIABLO COVE	15DEC82	RCM	D	D	D	2.80	D	2.40	D	D	1.00	6.2	D	1.70
3	434.00	S. DIABLO COVE	05OCT83	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	434.00	S. DIABLO COVE	16FEB84	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	435.00	INTAKE COVE	14DEC82	RCM	D	D	D	2.00	D	1.60	D	D	1.10	4.7	D	1.90
3	435.00	INTAKE COVE	05OCT83	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	435.00	INTAKE COVE	16FEB84	RCM	N	N	N	N	N	N	N	N	N	N	N	N
3	436.00	PECHO ROCK	07JAN83	RCM	D	D	D	4.70	D	3.40	D	D	10.00	18.1	D	2.70
3	436.00	PECHO ROCK	05OCT83	RCM	N	N	N	N	N	N	N	N	N	N	N	N

REG	STATION NUMBER	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
3	426.00	D	D	N	26.00	N	N	D	D	26.00	N	N	N	N	N
3	427.00	D	D	2.40	79.00	D	D	1.20	4.40	87.00	D	D	N	N	D
3	427.00	D	21.00	D	10.00	D	D	D	5.90	36.90	8.00	D	N	N	D
3	428.50	D	9.90	N	37.00	N	N	2.70	6.90	56.50	N	N	N	N	N
3	428.50	D	D	6.00	140.00	D	D	D	D	146.00	4.90	D	N	N	D
3	428.50	5.00	16.00	D	92.00	D	D	D	D	113.00	5.10	D	N	N	D
3	430.00	D	D	D	31.00	D	D	D	D	31.00	4.10	D	N	N	D
3	430.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	430.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	430.10	2.20	0.90	N	19.00	N	N	0.06	0.60	22.76	N	N	N	N	N
3	430.10	1.20	5.70	N	31.00	N	N	0.59	4.40	42.89	N	N	N	N	N
3	430.10	3.50	5.40	N	31.00	N	N	0.60	5.60	46.10	N	N	N	N	N
3	430.10	0.50	4.50	N	12.00	N	N	0.80	D	17.80	N	N	N	N	N
3	433.00	D	D	D	32.00	D	D	D	D	32.00	1.80	D	N	N	D
3	434.00	D	3.20	D	30.00	D	D	D	D	33.20	1.20	D	N	N	D
3	434.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	434.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	435.00	D	D	D	32.00	8.80	D	D	D	40.80	2.90	D	N	N	D
3	435.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	435.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3	436.00	D	D	4.50	58.00	8.50	D	D	D	71.00	8.10	D	N	N	D
3	436.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
3	426.00	N	N	N	N	N	N	N	34.00	N	34	N	N	N	N	N	N
3	427.00	D	0.37	2.00	10.00	D	D	D	66.00	D	66	N	N	D	5.50	D	D
3	427.00	D	1.00	6.30	D	2.30	D	D	98.00	D	98	N	N	D	D	D	D
3	428.50	N	N	N	N	N	N	N	50.00	N	50	N	N	N	N	N	N
3	428.50	D	D	D	D	D	D	D	170.00	D	170	N	N	D	D	D	D
3	428.50	D	1.00	4.60	D	1.90	D	D	120.00	D	120	N	N	D	D	D	D
3	430.00	D	D	7.00	D	D	D	D	45.00	D	45	N	N	D	D	D	D
3	430.00	N	N	N	N	N	N	N	D	D	D	N	N	N	N	N	N
3	430.00	N	N	N	N	N	N	N	22.00	D	22	N	N	N	N	N	N
3	430.10	N	N	N	N	N	N	N	19.00	N	19	N	N	N	N	N	N
3	430.10	N	N	N	N	N	N	N	6.00	N	6	N	N	N	N	N	N
3	430.10	N	N	N	N	N	N	N	27.00	N	27	N	N	N	N	N	N
3	430.10	N	N	N	N	N	N	N	18.00	N	18	N	N	N	N	N	N
3	433.00	D	D	4.10	D	D	D	D	62.00	D	62	N	N	D	D	D	D
3	434.00	D	D	4.60	D	D	D	D	81.00	D	81	N	N	D	D	D	D
3	434.00	N	N	N	N	N	N	N	28.00	D	28	N	N	N	N	N	N
3	434.00	N	N	N	N	N	N	N	40.00	D	40	N	N	N	N	N	N
3	435.00	D	D	3.90	D	D	D	D	78.00	D	78	N	N	D	D	D	D
3	435.00	N	N	N	N	N	N	N	19.00	D	19	N	N	N	N	N	N
3	435.00	N	N	N	N	N	N	N	24.00	D	24	N	N	N	N	N	N
3	436.00	D	D	12.00	D	D	D	D	290.00	D	290	N	N	D	D	D	D
3	436.00	N	N	N	N	N	N	N	40.00	D	40	N	N	N	N	N	N

S NA LOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS	DACTHAL
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
D	3.60	13.8	D	3.10
D	1.40	6.4	D	1.80
D	1.00	4.6	D	D
N	N	N	N	N
N	N	N	N	N
D	1.10	4.5	D	D
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
D	3.40	9.0	D	2.00
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N

DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
6.30	D	N	N	D
7.50	1.90	N	N	1.9
5.00	D	N	N	D
N	N	N	N	N
N	N	N	N	N
6.30	D	N	N	D
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
3.40	1.20	N	N	1.2
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N

A RO OL	PARA THION	RONNEL	TOXA PHENE	TEDION
	N	N	N	N
	N	N	N	N
	N	N	N	N
	D	D	D	D
	D	D	D	D
	D	D	D	D
	N	N	N	N
	N	N	N	N
	D	D	D	D
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N
	D	D	D	D
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N
	N	N	N	N

KY HLOR ANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
N	N	N	N	N
D	N	1.50	9.1	D
D	N	2.40	13.1	D
N	N	N	N	N
N	N	N	N	N

DO LFAN	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	N
[illegible]	N	N	D
[illegible]	N	N	D
[illegible]	N	N	N
[illegible]	N	N	N

ONNEL	TOXA PHENE	TEDION
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
N	N	N
D	D	D
D	D	D
N	N	N
N	N	N

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SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
23AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N
20DEC78	RCM	N	N	N	N	N	N	N	N	N	N	N
11NOV80	TCM	D	9.70	N	28.00	N	22.00	2.20	N	20.00	72.2	D
08FEB82	RBM	D	7.90	N	8.60	N	11.00	1.40	D	17.00	38.0	D
13MAY80	TCM	D	D	N	16.00	N	16.00	D	N	6.90	38.9	D
11NOV80	TCM	D	D	N	19.00	N	12.00	D	N	8.40	39.4	D
08FEB82	RBM	D	D	N	12.00	N	15.00	2.60	D	21.00	50.6	D
24JUL77	RCM	N	N	N	N	N	N	N	N	N	N	N
02DEC77	RCM	N	N	N	N	N	N	N	N	N	N	N
04AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N
16NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N
12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
29DEC83	TCM	N	N	N	N	N	N	N	N	N	N	N
12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
29DEC83	TCM	N	N	N	N	N	N	N	N	N	N	N
12NOV80	RBM	N	N	N	N	N	N	N	N	N	N	N
12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
25MAR83	RBM	N	N	N	N	N	N	N	N	N	N	N
30MAR79	RBM	N	N	N	N	N	N	N	N	N	N	N
03NOV79	RBM	0.40	D	N	20.00	N	23.00	D	N	20.00	63.0	D
12JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N

SAMPLE DATE	TYPE	DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
23AUG78	RCM	9.60	N	6.90	N	N	D	14.00	30.50	N	N	N	N	N
20DEC78	RCM	4.10	N	11.00	N	N	1.60	D	16.70	N	N	N	N	N
11NOV80	TCM	[illegible]0.00	5.60	290.00	16.00	D	D	49.00	431.60	18.00	D	N	N	D
08FEB82	RBM	[illegible]4.00	15.00	240.00	10.00	D	22.00	84.00	482.00	1.00	2.20	N	N	2.2
13MAY80	TCM	[illegible]0.00	22.00	340.00	D	D	17.00	85.00	609.00	4.80	2.30	N	N	2.3
11NOV80	TCM	[illegible]0.00	7.20	200.00	D	D	8.00	34.00	391.00	11.00	11.00	N	N	11.0
08FEB82	RBM	[illegible]0.00	D	260.00	33.00	12.00	24.00	83.00	790.00	5.00	5.00	N	N	5.0
24JUL77	RCM	23.00	N	83.00	N	N	0.29	10.00	126.29	N	N	N	N	N
02DEC77	RCM	D	N	70.00	N	N	D	4.20	74.20	N	N	N	N	N
04AUG78	RCM	[illegible]5.00	N	180.00	N	N	D	39.00	304.00	N	N	N	N	N
16NOV78	RCM	15.00	N	38.00	N	N	4.50	D	59.80	N	N	N	N	N
12JAN82	TCM	[illegible]0.00	40.00	520.00	D	52.00	38.00	96.00	1358.00	N	N	N	N	N
29DEC83	TCM	[illegible]0.00	44.00	900.00	D	48.00	16.00	290.00	1925.00	N	N	N	N	N
12JAN82	TCM	[illegible]0.00	120.00	660.00	25.00	44.00	29.00	59.00	1602.00	N	N	N	N	N
12JAN82	TCM	[illegible]0.00	81.00	550.00	30.00	35.00	15.00	49.00	1111.00	N	N	N	N	N
29DEC83	TCM	[illegible]0.00	46.00	610.00	D	38.00	10.00	95.00	1163.00	N	N	N	N	N
12NOV80	RBM	[illegible]0.00	110.00	1500.00	98.00	86.00	D	86.00	2460.00	N	N	N	N	N
12JAN82	TCM	[illegible]0.00	190.00	1100.00	65.00	47.00	15.00	41.00	1939.00	N	N	N	N	N
25MAR83	RBM	[illegible]0.00	110.00	840.00	55.00	52.00	63.00	260.00	1610.00	N	N	N	N	N
30MAR79	RBM	[illegible]0.00	N	230.00	N	N	44.00	74.00	545.00	N	N	N	N	N
03NOV79	RBM	[illegible]0.00	120.00	970.00	74.00	D	11.00	11.00	1358.00	7.20	D	N	N	D
12JAN82	TCM	[illegible]1.00	36.00	760.00	40.00	27.00	4.50	13.00	1031.50	N	N	N	N	N

SAMPLE DATE	TYPE	[illegible]HA [illegible]	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
23AUG78	RCM	[illegible]	N	N	N	N	18.00	N	18	N	N	N	N	N	N
20DEC78	RCM	[illegible]	N	N	N	N	16.00	N	16	N	N	N	N	N	N
11NOV80	TCM	[illegible]30	1.70	1.70	D	D	770.00	D	770	N	N	D	D	D	D
08FEB82	RBM	[illegible]90	D	D	D	D	220.00	D	220	N	N	D	D	210.00	D
13MAY80	TCM	[illegible]50	D	1.00	D	D	1300.00	D	1300	N	N	D	D	D	D
11NOV80	TCM	[illegible]50	D	4.00	D	D	2000.00	D	2000	N	N	D	D	D	D
08FEB82	RBM	[illegible]10	D	1.30	2.00	D	1400.00	D	1400	N	N	D	D	140.00	D
24JUL77	RCM	[illegible]	N	N	N	N	64.00	N	64	N	N	N	N	N	N
02DEC77	RCM	[illegible]	N	N	N	N	150.00	N	150	N	N	N	N	N	N
04AUG78	RCM	[illegible]	N	N	N	N	220.00	N	220	N	N	N	N	N	N
16NOV78	RCM	[illegible]	N	N	N	N	93.00	N	93	N	N	N	N	N	N
12JAN82	TCM	[illegible]	N	N	N	N	1400.00	D	1400	N	N	N	N	N	N
29DEC83	TCM	[illegible]	N	N	N	N	1700.00	460.00	2160	N	N	N	N	N	N
12JAN82	TCM	[illegible]	N	N	N	N	2000.00	D	2000	N	N	N	N	N	N
12JAN82	TCM	[illegible]	N	N	N	N	920.00	D	920	N	N	N	N	N	N
29DEC83	TCM	[illegible]	N	N	N	N	1000.00	D	1000	N	N	N	N	N	N
12NOV80	RBM	[illegible]	N	N	N	N	1600.00	D	1600	N	N	N	N	N	N
12JAN82	TCM	[illegible]	N	N	N	N	960.00	D	960	N	N	N	N	N	N
25MAR83	RBM	[illegible]	N	N	N	N	1100.00	D	1100	N	N	N	N	N	N
30MAR79	RBM	[illegible]	N	N	N	N	270.00	N	270	N	N	N	N	N	N
03NOV79	RBM	[illegible]	D	D	0.89	D	450.00	D	450	N	N	D	D	D	D
12JAN82	TCM	[illegible]	N	N	N	N	370.00	D	370	N	N	N	N	N	N

NS OR	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
.00	8.10	N	22.00	75.1	D
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
.00	D	N	54.00	163.0	D
.00	4.90	N	35.00	115.9	D
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N
[illegible]	N	N	N	N	N

AL	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
.0	N	N	N	N	N
.1	N	N	N	N	N
.0	13.00	D	N	N	D
.2	N	N	N	N	N
.0	N	N	N	N	N
.4	N	N	N	N	N
.0	22.00	D	N	N	D
.0	35.00	D	N	N	D
.1	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N
.2	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N
.8	N	N	N	N	N
.0	N	N	N	N	N
.9	N	N	N	N	N
.0	N	N	N	N	N
.0	N	N	N	N	N

RO OL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
	N	N	N	N	N
	N	N	N	N	N
	N	D	D	D	D
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	D	2.90	D	D
	N	D	D	D	D
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N
	N	N	N	N	N

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TYPE	ALDRIN	CHLORBENSIDE	ALPHA CHLORDENE	CIS CHLORDANE	GAMMA CHLORDENE	TRANS CHLORDANE	OXY CHLORDANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLORDANE	CHLORPYRIFOS
BM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	D	N	D	310.00	N	210.00	23.00	D	260.00	803.0	D
CM	D	61.00	N	150.00	N	170.00	9.20	4.80	160.00	494.0	D
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	D	D	N	19.00	N	17.00	1.80	N	11.00	48.8	D
CM	D	5.90	N	17.00	N	13.00	2.90	N	16.00	48.9	D
CM	D	D	N	11.00	N	8.60	1.70	D	10.00	31.5	D
CM	D	5.60	1.00	13.00	D	17.00	D	D	12.00	48.0	D
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	D	N	D	5.10	N	1.90	D	D	2.70	9.7	D
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N
CM	N	N	N	N	N	N	N	N	N	N	N

PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
790.00	55.00	23.00	120.00	670.00	2231.00	N	N	N	N	N
880.00	D	D	10.00	290.00	2016.00	N	N	N	N	N
560.00	17.00	11.00	D	16.00	759.00	N	N	N	N	N
650.00	67.00	97.00	D	92.00	1630.00	91.00	D	N	N	D
320.00	30.00	35.00	22.00	35.00	673.00	19.00	D	N	N	D
820.00	47.00	14.00	D	18.00	1051.00	N	N	N	N	N
100.00	N	N	1.70	17.00	1169.70	N	N	N	N	N
100.00	N	N	D	D	1175.00	N	N	N	N	N
300.00	N	N	D	28.00	487.00	N	N	N	N	N
266.00	N	N	14.00	31.00	456.00	N	N	N	N	N
900.00	32.00	29.00	2.60	20.00	2316.60	D	D	N	N	D
300.00	67.00	19.00	D	18.00	1705.00	3.70	D	N	N	D
300.00	57.00	D	D	D	1635.00	6.50	D	N	N	D
100.00	47.00	23.00	D	14.00	1423.00	11.00	D	N	N	D
710.00	7.80	14.00	D	7.80	867.60	N	N	N	N	N
500.00	110.00	33.00	D	20.00	2057.00	N	N	N	N	N
9.00	N	N	0.40	57.00	80.40	N	N	N	N	N
9.00	N	N	D	D	12.30	N	N	N	N	N
28.00	D	D	D	4.00	40.80	D	D	N	N	D
49.00	N	N	2.20	13.00	75.80	N	N	N	N	N
12.00	N	N	1.70	1.90	19.00	N	N	N	N	N
23.00	N	N	D	9.00	44.00	N	N	N	N	N

MA	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
	N	N	1400.00	D	1400	N	N	N	N	N	N
	N	N	960.00	56.00	1016	N	N	N	N	N	N
	N	N	110.00	D	110	N	N	N	N	N	N
.70	5.70	D	1800.00	D	1800	N	N	D	D	D	D
.00	D	D	1000.00	D	1000	N	N	D	D	D	D
	N	N	420.00	D	420	N	N	N	N	N	N
	N	N	290.00	N	290	N	N	N	N	N	N
	N	N	320.00	N	320	N	N	N	N	N	N
	N	N	230.00	N	230	N	N	N	N	N	N
	N	N	250.00	N	250	N	N	N	N	N	N
.00	D	D	560.00	D	560	N	N	D	D	D	D
.70	1.60	N	390.00	D	390	N	N	D	D	D	D
.96	D	D	150.00	D	150	N	N	D	D	D	D
.80	D	1.00	290.00	D	290	N	N	D	D	D	D
	N	N	170.00	D	170	N	N	N	N	N	N
	N	N	600.00	D	600	N	N	N	N	N	N
	N	N	35.00	N	35	N	N	N	N	N	N
	N	N	17.00	N	17	N	N	N	N	N	N
.70	D	D	52.00	D	52	N	N	D	N	D	D
	N	N	55.00	N	56	N	N	N	N	N	N
	N	N	57.00	N	57	N	N	N	N	N	N
	N	N	41.00	N	41	N	N	N	N	N	N

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
4	681.00	CATALINA I. WEST	19DEC78	RCM	N	N	N	N	N	N	N	N	N	N	N
4	683.00	CATALINA BEN WESTON	09DEC80	RCM	D	N	D	1.90	N	1.50	D	D	1.00	4.4	D
4	701.00	COLORADO LAGOON	11JAN82	RBM	D	290.00	N	550.00	N	480.00	27.00	43.00	430.00	1530.0	D
4	703.00	PIER 22	11JAN82	RBM	D	25.00	N	72.00	N	96.00	3.60	3.10	82.00	256.7	D
8	707.00	ANAHEIM NAVY HARBOR	29DEC83	TCM	D	18.00	D	42.00	D	34.00	3.60	N	D	79.8	D
8	708.00	ANAHEIM NAVY MARSH	29DEC83	TCM	D	18.00	3.00	45.00	D	32.00	3.20	N	D	83.2	D
8	709.00	AB ENTRANCE	11JAN82	RBM	D	D	N	71.00	N	47.00	4.20	18.00	54.00	194.2	D
8	710.00	ANAHEIM FUEL DOCK	17MAY80	TCM	1.60	D	N	94.00	N	120.00	D	N	100.00	314.0	D
8	710.00	ANAHEIM FUEL DOCKS	04FEB81	RBM	D	N	D	140.00	N	130.00	8.60	D	165.00	443.6	D
8	711.00	LAUNCH RAMP DOCKS	11JAN82	RBM	D	D	N	110.00	N	140.00	7.40	5.70	94.00	357.1	D
8	712.00	PETERS LANDING	11JAN82	RBM	D	100.00	D	110.00	D	120.00	7.60	3.30	110.00	350.9	D
8	713.00	ANAHEIM EDINGER ST	29DEC83	TCM	D	36.00	5.10	81.00	D	62.00	5.60	N	D	153.7	5.70
8	715.00	ANAHEIM WARNER AV BR	29DEC83	TCM	D	40.00	6.90	150.00	D	100.00	5.90	N	D	262.8	10.00
8	721.00	NEWPORT BAY ENTRANCE	30DEC82	TCM	N	N	3.30	71.00	2.30	38.00	1.30	D	45.00	160.9	D
8	721.00	NEWPORT BAY ENTRANCE	27DEC83	TCM	N	N	D	64.00	D	46.00	2.60	N	11.00	123.6	N
8	722.00	N.B. POLICE DOCKS	14DEC79	TCM	D	D	N	9.10	N	9.10	D	N	7.80	26.0	D
8	722.00	N.B. POLICE DOCKS	17MAY80	TCM	D	N	D	80.00	N	42.00	12.00	D	65.00	199.0	D
8	722.00	N.B. POLICE DOCKS	30DEC82	TCM	N	N	5.20	110.00	3.10	69.00	1.70	D	76.00	265.0	D
8	723.00	BAY ISLAND	11JAN82	TCM	D	110.00	D	110.00	D	120.00	11.00	D	81.00	322.0	D
8	723.00	BAY ISLAND	30DEC82	RBM	N	N	10.00	110.00	8.70	160.00	1.90	D	160.00	450.6	D
8	723.00	BAY ISLAND	04JAN84	TCM	N	N	12.00	230.00	D	150.00	8.70	N	78.00	478.7	N
8	724.00	N.B. HWY. 1 BRIDGE	30DEC82	TCM	D	D	12.00	120.00	5.00	120.00	5.20	26.00	140.00	428.2	D

REG	STATION NUMBER	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
4	681.00	N	D	4.50	N	9.00	N	N	0.80	5.30	19.60	N	N	N	N	N
4	683.00	D	D	D	D	14.00	D	D	D	D	14.00	1.00	D	N	N	D
4	701.00	3.20	39.00	280.00	230.00	460.00	43.00	D	D	94.00	1146.00	67.00	D	N	N	D
4	703.00	D	20.00	110.00	30.00	610.00	38.00	18.00	14.00	11.00	851.00	6.80	D	N	N	D
8	707.00	D	22.00	100.00	12.00	580.00	D	D	D	59.00	773.00	19.00	D	N	N	D
8	708.00	2.20	27.00	110.00	13.00	500.00	D	24.00	D	65.00	739.00	20.00	D	N	N	D
8	709.00	D	36.00	160.00	47.00	1000.00	49.00	22.00	40.00	100.00	1454.00	7.00	D	N	N	D
8	710.00	D	44.00	D	70.00	1100.00	67.00	D	33.00	55.00	1369.00	34.00	D	N	N	D
8	710.00	3.80	46.00	420.00	4.20	970.00	51.00	51.00	56.00	200.00	1798.20	11.00	2.20	N	N	2.2
8	711.00	D	53.00	420.00	35.00	1100.00	43.00	28.00	69.00	300.00	2048.00	2.00	D	N	N	D
8	712.00	3.60	57.00	380.00	37.00	1300.00	45.00	30.00	67.00	270.00	2186.00	13.00	D	N	N	D
8	713.00	3.40	52.00	210.00	6.80	730.00	D	D	10.00	180.00	1188.80	38.00	D	N	N	D
8	715.00	5.00	46.00	340.00	4.60	1200.00	D	D	5.20	100.00	1695.80	59.00	3.80	N	N	3.8
8	721.00	N	33.00	130.00	25.00	920.00	22.00	9.20	7.80	62.00	1209.00	N	N	N	N	N
8	721.00	N	27.00	310.00	6.40	690.00	D	D	4.80	130.00	1370.20	N	N	N	N	N
8	722.00	D	9.70	32.00	D	32.00	D	D	D	D	73.70	25.00	D	N	N	D
8	722.00	36.00	60.00	430.00	39.00	880.00	56.00	25.00	D	39.00	1529.00	41.00	D	N	N	D
8	722.00	N	75.00	650.00	39.00	1700.00	53.00	D	12.00	67.00	2595.00	N	N	N	N	N
8	723.00	15.00	100.00	680.00	34.00	1900.00	54.00	73.00	29.00	100.00	3170.00	31.00	3.20	N	N	3.2
8	723.00	N	170.00	920.00	65.00	3100.00	65.00	D	24.00	300.00	4644.00	N	N	N	N	N
8	723.00	N	120.00	940.00	48.00	2900.00	6.70	D	23.00	340.00	4377.70	N	N	N	N	N
8	724.00	19.00	110.00	760.00	88.00	2200.00	85.00	D	49.00	120.00	3412.00	44.00	D	N	N	D

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
4	681.00	N	N	N	N	N	N	N	19.00	N	19	N	N	N	N	N	N
4	683.00	D	D	3.10	D	0.70	D	D	33.00	D	33	N	N	D	D	D	D
4	701.00	D	D	4.20	D	4.80	15.00	D	760.00	D	760	N	N	D	D	120.00	D
4	703.00	D	D	2.60	D	0.95	2.10	D	660.00	D	660	N	N	D	D	D	D
8	707.00	D	D	1.90	D	4.90	D	2.00	330.00	D	330	N	N	D	D	D	D
8	708.00	D	D	3.00	D	9.10	D	2.60	340.00	D	340	N	N	D	D	D	D
8	709.00	D	0.60	2.50	D	1.60	D	D	590.00	D	590	N	N	D	D	D	D
8	710.00	D	0.31	1.80	D	2.00	1.20	D	1000.00	D	1000	N	N	D	1.60	D	D
8	710.00	D	D	3.20	D	8.50	5.70	D	2400.00	D	2400	N	N	D	D	D	D
8	711.00	D	57.00	2.60	2.10	2.80	3.00	D	760.00	D	760	N	N	D	D	320.00	D
8	712.00	D	0.93	3.30	2.40	3.60	3.60	D	840.00	D	840	N	N	D	D	300.00	D
8	713.00	D	D	2.00	D	11.00	D	5.60	480.00	D	480	N	N	D	D	270.00	D
8	715.00	D	D	1.50	D	9.90	D	4.60	710.00	D	710	N	N	D	D	220.00	D
8	721.00	N	N	N	N	N	N	N	320.00	D	320	N	N	D	D	D	N
8	721.00	N	N	N	N	N	N	N	260.00	D	260	N	N	N	N	N	N
8	722.00	D	0.26	0.78	D	0.97	D	0.97	250.00	D	250	N	N	D	1.70	D	D
8	722.00	D	D	4.90	D	3.60	D	D	540.00	D	540	N	N	D	D	D	D
8	722.00	N	N	N	N	N	N	N	800.00	D	800	N	N	D	D	D	N
8	723.00	D	D	3.80	1.80	4.20	D	D	620.00	D	620	N	N	D	D	260.00	D
8	723.00	N	N	N	N	N	N	N	1000.00	D	1000	N	N	D	D	D	N
8	723.00	N	N	N	N	N	N	N	710.00	D	710	N	N	N	N	N	N
8	724.00	D	D	2.60	D	3.10	D	4.20	790.00	D	790	N	N	D	D	D	D

ATCH - ORGANICS

ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
6.20	210.00	D	110.00	6.30	D	16.00	348.5	D
D	130.00	D	100.00	13.00	D	92.00	335.0	D
16.00	120.00	6.20	82.00	5.20	39.00	110.00	378.4	D
9.30	170.00	D	89.00	8.70	D	45.00	322.0	D
12.00	160.00	4.30	74.00	4.10	D	110.00	354.4	D
6.10	160.00	D	83.00	9.40	N	31.00	289.5	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	35.00	N	26.00	D	N	7.20	68.2	D
D	31.00	N	21.00	2.60	D	18.00	72.6	D
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	N	N	N	N	N	N	N	N
N	15.00	N	17.00	D	N	10.00	42.0	D
D	36.00	N	33.00	3.60	D	20.00	92.6	D
D	15.00	D	14.00	2.30	D	13.00	44.3	D
D	22.00	D	16.00	D	D	10.00	48.0	D
D	11.00	D	6.00	D	N	D	19.0	D
N	N	N	N	N	N	N	N	N

'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
.80	330.00	3832.80	N	N	N	N	N
.00	38.00	1947.00	50.00	6.10	N	N	6.1
D	41.00	2416.00	40.00	D	N	N	D
D	63.00	1911.00	N	N	N	N	N
.00	43.00	1925.00	N	N	N	N	N
.60	86.00	1577.60	N	N	N	N	N
.00	22.00	153.70	N	N	N	N	N
.00	8.50	63.40	N	N	N	N	N
.00	3.00	197.00	N	N	N	N	N
.90	14.00	103.20	N	N	N	N	N
D	9.80	204.70	8.40	D	N	N	D
.60	20.00	329.20	11.00	D	N	N	D
.70	16.00	85.30	N	N	N	N	N
.60	8.00	67.00	N	N	N	N	N
.50	21.00	169.70	N	N	N	N	N
.40	14.00	126.40	N	N	N	N	N
D	13.00	154.40	2.30	D	N	N	D
.00	71.00	652.00	22.00	6.30	N	N	6.3
.00	65.00	350.70	8.10	D	N	N	D
.80	27.00	232.70	23.00	D	N	N	D
.10	94.00	425.00	D	21.00	N	N	21.0
.00	8.20	54.99	N	N	N	N	N

PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
D	450	N	N	N	D	880.00	N
D	5000	N	N	D	D	260.00	D
D	4700	N	N	D	D	D	D
460.00	3060	N	N	N	D	480.00	N
D	4600	N	N	N	D	D	N
200.00	2980	N	N	N	N	N	N
N	110	N	N	N	N	N	N
N	94	N	N	N	N	N	N
N	170	N	N	N	N	N	N
N	97	N	N	N	N	N	N
D	250	N	N	D	D	D	D
D	330	N	N	D	D	D	D
N	77	N	N	N	N	N	N
N	90	N	N	N	N	N	N
N	61	N	N	N	N	N	N
N	130	N	N	N	N	N	N
D	130	N	N	D	D	D	D
D	220	N	N	D	D	D	D
D	74	N	N	D	D	230.00	D
D	74	N	N	D	D	D	D
D	52	N	N	D	D	270.00	D
N	58	N	N	N	N	N	N

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
9	832.00	LA JOLLA	06AUG78	RCM	N	N	N	N	N	N	N	N	N	N	N
9	832.00	LA JOLLA	20NOV78	RCM	N	N	N	N	N	N	N	N	N	N	N
9	832.00	LA JOLLA	31OCT79	RCM	D	D	N	12.00	N	14.00	D	N	3.90	29.9	D
9	839.00	PT. LOMA PINK HOUSE	09JAN82	RCM	D	D	D	8.10	D	4.90	1.10	D	5.20	19.3	D
9	840.00	NOSC DOLPHIN TANKS	03JAN83	RCM	D	D	D	11.00	D	11.00	D	D	8.80	30.8	D
9	865.00	M.B. HILTON DOCKS	28DEC83	TCM	33.00	28.00	D	92.00	D	50.00	8.00	N	D	150.0	4.30
9	867.00	INGRAHAM ST	20JUN80	RBM	D	D	N	36.00	N	37.00	D	N	50.00	123.0	D
9	867.00	INGRAHAM ST	09JAN82	RBM	N	N	N	N	N	N	N	N	N	N	N
9	869.00	M.B. SEAWORLD THR.	28DEC83	TCM	3.70	D	D	20.00	D	14.00	D	N	D	34.0	D
9	870.00	M. B. SO.SHO. ROC. 1	28DEC83	TCM	4.20	6.40	D	22.00	D	12.00	3.10	N	D	37.1	2.30
9	872.00	M. B. SO.SHO. ROC. 3	28DEC83	TCM	2.80	14.00	D	34.00	D	22.00	1.60	N	D	57.6	9.00
9	873.00	MISSION BAY	13NOV80	TCM	D	N	D	30.00	N	17.00	4.10	D	34.00	85.1	D
9	874.00	M.B. S.D. RIVER CH.	28DEC83	TCM	D	26.00	D	90.00	D	57.00	3.30	D	D	150.3	D
9	880.00	NATIONAL CITY	13DEC80	RBM	N	N	N	N	N	N	N	N	N	N	N
9	881.00	SWEETWATER MARSH	29DEC82	RBM	N	N	N	N	N	N	N	N	N	N	N
9	882.00	24TH ST. MAR TERM S.	17JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
9	883.00	NAVY AMPHIB. BASE	13DEC80	RBM	N	N	N	N	N	N	N	N	N	N	N
9	883.00	NAVY AMPHIB. BASE	07JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
9	884.00	GLORIETTA BAY	07JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
9	885.00	BUOY 30	07JAN82	RCM	N	N	N	N	N	N	N	N	N	N	N
9	887.00	EVENS STREET	07JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
9	887.00	EVANS STREET	29DEC82	TCM	N	N	N	N	N	N	N	N	N	N	N

REG	STATION NUMBER	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
9	832.00	N	4.80	17.00	N	15.00	N	N	3.60	19.00	59.4	N	N	N	N	N
9	832.00	N	D	7.40	N	10.00	N	N	4.80	D	22.2	N	N	N	N	N
9	832.00	D	D	D	D	25.00	D	D	D	D	25.0	1.60	D	N	N	D
9	839.00	D	D	7.50	D	63.00	D	D	D	D	70.5	1.90	D	N	N	D
9	840.00	D	17.00	19.00	3.00	150.00	5.60	D	15.00	9.00	218.6	5.90	D	N	N	D
9	865.00	D	16.00	16.00	D	43.00	D	D	D	6.00	81.0	85.00	D	N	N	D
9	867.00	D	17.00	32.00	22.00	220.00	24.00	D	19.00	11.00	345.0	9.90	D	N	N	D
9	867.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	869.00	D	24.00	11.00	D	75.00	D	D	D	D	110.0	18.00	D	N	N	D
9	870.00	D	50.00	9.40	D	66.00	D	D	D	D	125.4	17.00	D	N	N	D
9	872.00	D	95.00	15.00	D	50.00	D	D	D	D	160.0	21.00	D	N	N	D
9	873.00	D	15.00	57.00	6.40	140.00	7.50	D	D	9.10	235.0	19.00	D	N	N	D
9	874.00	D	14.00	30.00	D	97.00	D	D	D	10.00	151.0	31.00	D	N	N	D
9	880.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	881.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	882.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	883.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	883.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	884.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	885.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	887.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	887.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
9	832.00	N	N	N	N	N	N	N	93.00	N	93	N	N	N	N	N	N
9	832.00	N	N	N	N	N	N	N	88.00	N	88	N	N	N	N	N	N
9	832.00	D	0.25	1.20	D	8.80	D	D	37.00	D	37	N	N	D	D	D	D
9	839.00	D	D	5.80	D	1.30	D	D	D	D	D	N	N	D	D	D	D
9	840.00	D	D	2.80	D	7.30	D	D	220.00	D	220	N	N	D	D	D	D
9	865.00	D	D	2.70	D	3.90	D	4.20	140.00	D	140	N	N	D	D	D	D
9	867.00	D	D	1.90	12.00	0.75	D	D	230.00	D	230	N	N	D	3.30	D	D
9	867.00	N	N	N	N	N	N	N	210.00	D	210	N	N	N	N	N	N
9	869.00	D	D	2.00	D	1.20	D	D	260.00	D	260	N	N	D	D	D	D
9	870.00	D	D	1.50	D	0.95	D	D	270.00	D	270	N	N	D	D	D	D
9	872.00	D	D	2.40	D	2.00	D	2.00	380.00	D	380	N	N	D	D	D	D
9	873.00	D	D	4.60	2.00	2.50	D	D	190.00	D	190	N	N	D	D	D	D
9	874.00	D	D	2.80	D	3.60	D	2.20	360.00	D	360	N	N	D	D	D	D
9	880.00	N	N	N	N	N	N	N	1500.00	D	1500	N	N	N	N	N	N
9	881.00	N	N	N	N	N	N	N	540.00	D	540	N	N	N	N	N	N
9	882.00	N	N	N	N	N	N	N	700.00	D	700	N	N	N	N	N	N
9	883.00	N	N	N	N	N	N	N	3400.00	D	3400	N	N	N	N	N	N
9	883.00	N	N	N	N	N	N	N	990.00	D	990	N	N	N	N	N	N
9	884.00	N	N	N	N	N	N	N	840.00	D	840	N	N	N	N	N	N
9	885.00	N	N	N	N	N	N	N	490.00	D	490	N	N	N	N	N	N
9	887.00	N	N	N	N	N	N	N	1100.00	D	1100	N	N	N	N	N	N
9	887.00	N	N	N	N	N	N	N	1900.00	D	1900	N	N	N	N	N	N

…NA …OR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
	59.00	161.9	D
	44.00	127.1	D
	N	N	N
	N	N	N
	N	N	N
	18.00	71.7	D
	N	N	N
	34.00	116.0	D
	N	N	N
	N	N	N
	N	N	N
	N	N	N
	N	N	N
	N	N	N
	13.00	51.5	D
	N	N	N
	N	N	N
	N	N	N
	N	N	N
	N	N	N
	27.00	71.2	D
	23.00	51.0	D

…	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
	N	D
	N	D
	N	N
	N	N
	N	N
	N	D
	N	N
	N	D
	N	N
	N	N
	N	N
	N	N
	N	N
	N	N
	N	D
	N	N
	N	N
	N	N
	N	N
	N	N
	N	D
	N	D

…NEL	TOXA PHENE	TEDION
00	D	D
	D	D
	N	N
	N	N
	N	N
	D	D
	N	N
	D	D
	N	N
	N	N
	N	N
	N	N
	N	N
	N	N
	D	D
	N	N
	N	N
	N	N
	N	N
	N	N
40	D	D
00	D	D

STATE MUSSEL WATCH - ORGANICS

REG	STATION NUMBER	STATION NAME	SAMPLE DATE	TYPE	ALDRIN	CHLOR BENSIDE	ALPHA CHLOR DENE	CIS CHLOR DANE	GAMMA CHLOR DENE	TRANS CHLOR DANE	OXY CHLOR DANE	CIS NONA CHLOR	TRANS NONA CHLOR	TOTAL CHLOR DANE	CHLOR PYRIFOS
9	899.00	SHELTER ISLAND DOCKS	13NOV80	TCM	D	N	D	37.00	N	16.00	3.40	D	22.00	78.4	D
9	901.00	DEGAUSING STATION	07JAN82	TCM	N	N	N	N	N	N	N	N	N	N	N
9	901.00	DEGAUSING STATION	06JAN83	TCM	N	N	N	N	N	N	N	N	N	N	N
9	902.00	ZUNIGA JETTY	15DEC80	RBM	N	N	N	N	N	N	N	N	N	N	N
9	903.00	ZUNIGA JETTY	04JAN84	TCM	D	D	D	5.20	D	4.30	D	D	D	9.5	D
9	905.00	TIJUANA RIVER	04JAN84	TCM	D	D	D	5.80	D	4.20	D	N	D	10.0	D

REG	STATION NUMBER	DACTHAL	OP'DDD	PP'DDD	OP'DDE	PP'DDE	PP'DDMU	PP'DDMS	OP'DDT	PP'DDT	TOTAL DDT	DIELDRIN	ENDO SULFAN I	ENDO SULFAN II	ENDO SULFAN SULFATE	TOTAL ENDO SULFAN
9	899.00	D	29.00	100.00	D	290.00	26.00	13.00	D	26.00	484.0	20.00	D	N	N	D
9	901.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	901.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	902.00	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9	903.00	D	9.30	21.00	D	160.00	D	D	D	9.30	200.1	3.40	D	N	N	D
9	905.00	D	12.00	27.00	4.00	260.00	D	D	D	14.00	317.0	5.80	D	N	N	D

REG	STATION NUMBER	ENDRIN	HEXA CHLORO BENZENE	ALPHA HCH	BETA HCH	GAMMA HCH	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	PCB 1254	PCB 1248	TOTAL PCB	PENTA CHLORO PHENOL	TETRA CHLORO PHENOL	PARA THION	RONNEL	TOXA PHENE	TEDION
9	899.00	D	D	4.50	D	2.20	1.00	D	1000.00	D	1000	N	N	D	D	D	D
9	901.00	N	N	N	N	N	N	N	180.00	D	180	N	N	N	N	N	N
9	901.00	N	N	N	N	N	N	N	430.00	D	430	N	N	N	N	N	N
9	902.00	N	N	N	N	N	N	N	770.00	D	770	N	N	N	N	N	N
9	903.00	D	D	2.20	D	0.70	D	D	150.00	D	150	N	N	D	D	D	D
9	905.00	D	D	3.70	D	1.20	D	D	110.00	D	110	N	N	D	D	D	D

APPENDIX C: Standards

The U.S. Food and Drug Administration (USFDA) has established tolerances and action levels for many of the toxic substances identified by the State Mussel Watch program. Tolerances and action levels are limiting concentrations above which USFDA will take legal action to remove from commerce food products that contain the listed substance. Table C-1 lists the toxic substances for which a tolerance or action level has been established by the USFDA.

Table C-1

U.S.F.D.A. Tolerances and Action Levels

Substance	Action Level or Tolerance	Commodity	Comments
Aldrin	0.3 ppm	Fish and Shellfish	
Dieldrin	0.3 ppm	Fish and Shellfish	
Chlordane	0.3 ppm	Fish	
DDT, DDE, DDD	5.0 ppm	Fish	Singly or in combination
Endrin	0.3 ppm	Fish and Shellfish	
Heptachlor	0.3 ppm	Fish and Shellfish	
Heptachlor Epoxide	0.3 ppm	Fish and Shellfish	
Kepone	0.3 ppm	Fish and Shellfish	
Kepone	0.4 ppm	Crabment	
Mirex	0.1 ppm	Fish	
PCB	2.0 ppm	Fish and Shellfish	
Toxaphene	5.0 ppm	Fish	
Mercury	1.0 ppm as methyl mercury	Edible portion of Fish, Shellfish, Crustaceans, and Other Aquatic Animals	

Notes: All values are fresh weight (wet weight). All substances are action levels as of June 1984, except that PCB is a tolerance level.

As the U.S.F.D.A. tolerance and action levels are listed on a fresh weight (wet weight) basis, they cannot be compared directly with the SMW results, which are listed on a dry weight basis. The SMW finding, however, can be converted to a wet weight basis by using the percentage of water in the SMW sample. The SMW results were compared with the USFDA standards using this method.

Only one substance (PCB) at one station (East Basin, San Diego Bay) exceeded a U.S.F.D.A. tolerance or action level. This finding is discussed in Section 3.3.13. Other than for the toxic substances listed in Table C-1, there is no U.S.F.D.A. or other standard in fish and foods. Many other countries, however, have established standards for foods containing toxic metals. Table C-2 lists these international standards, and Table C-3 lists the median values of

Table C-2

International Standards for Trace Elements in Fish and Molluscs*

Element	Standard	Freshwater Fish	Marine Fish	Molluscs/ Shellfish	Country	Approximate Date of Adoption
Antimony	1.0 ppm	x	x	x	Hong Kong	1983
	1.0 ppm	x	x	x	New Zealand	1971
	1.5 ppm	x	x	x	Australia	1982
Arsenic	0.1 ppm	x	x	x	Venezuela	-
	1.0 ppm	x	x	x	Chile	-
	1.0 ppm	d	d	x	India	-
	1.0 ppm	x	x	x	New Zealand	1971
	1.0 ppm	e	e	e	United Kingdom	1959
	1.4 ppm			x	Hong Kong	1983
	1.5 ppm	x	x	x	Australia	1982
	1.5 ppm	c	c	c	Thailand	1982
	3.5 ppm	P	P		Canada	1976
	5.0 ppm	x	x	x	Finland	1980
	5.0 ppm	x	x	x	Zambia	1976
Cadmium	0.05 ppm	x	x		Netherlands	-
	0.1 ppm	c	c	c	Switzerland	1982
	0.1 ppm		r	x	Venezuela	-
	0.2 ppm	x	x		Australia	1982
	0.3 ppm	r	r		Finland	-
	0.5 ppm	x			W. Germany	1979
	1.0 ppm			x	Netherlands	-
	1.0 ppm	x	x		New Zealand	1971
	2.0 ppm			x	Australia	1982
	2.0 ppm	x	x	x	Hong Kong	1983
Chromium	1.0 ppm	x	x	x	Hong Kong	1983
Copper	10.0 ppm	x	x	x	Chile	-
	10.0 ppm	d	d		India	-
	10.0 ppm		x	x	Venezuela	-

Table C-2
Con't

Element	Standard	Freshwater Fish	Marine Fish	Molluscs/ Shellfish	Country	Approximate Date of Adoption
Copper (con't)	20 ppm	c	c	c	Thailand	1982
	20 ppm	g	g	g	United Kingdom	1956
	30 ppm	x	x	x	Australia	1982
	30 ppm	x	x	x	New Zealand	1971
	100 ppm	x	x		Zambia	1976
Fluoride	150 ppm	P	P		Canada	1979
Fluorine	10 ppm	x	x		New Zealand	1971
	25 ppm	x	x		Zambia	1976
Lead	0.5 ppm	P	P		Canada	1979
	0.5 ppm	x			W. Germany	1979
	0.5 ppm	x	x		Netherlands	-
	1.0 ppm	x	x	x	Sweden	1979
	1.0 ppm	c	c	c	Switzerland	1982
	1.0 ppm	c	c	c	Thailand	1982
	2.0 ppm	x	x		Australia	1982
	2.0 ppm	x	x	x	Chile	1982
	2.0 ppm			x	Finland	1980
	2.0 ppm			x	Italy	1978
	2.0 ppm			x	Netherlands	-
	2.0 ppm	x	x		New Zealand	-
	2.0 ppm	l	l		Sweden	1979
	2.0 ppm	x	x		United Kingdom	1980
	2.0 ppm		x	x	Venezuela	-
	2.5 ppm			x	Australia	1982
	5.0 ppm	d	d		India	-
	6.0 ppm	x	x	x	Hong Kong	1983
	10.0 ppm	x	x		Zambia	1976

Table C-2
(con't)

Element	Standard	Freshwater Fish	Marine Fish	Molluscs/ Shellfish	Country	Approximate Date of Adoption
Mercury	International Standards for Mercury range from 0.1 ppm to 1.0 ppm. Twenty- eight countries have established standards for Mercury. The U. S. Food and Drug Administration has set an action level of 1.0 ppm in the edible portion of fish and molluscs. The median international standard is 0.5 ppm.					
Selenium	0.3 ppm	x	x	x	Chile	1982
	2.0 ppm	x	x		Australia	1982
	2.0 ppm	x	x		New Zealand	1971
Tin	50 ppm	x	x		Australia	1982
	100 ppm		x	x	Venezuela	-
	150 ppm	c	c	c	Finland	1979
	150 ppm	x	x		New Zealand	1977
	230 ppm	x	x	x	Hong Kong	1983
	250 ppm	d	d		India	-
	250 ppm	x	x		Thailand	1982
	250 ppm	g,c	g,c	g,c	United Kingdom	1973
Zinc	40 ppm	x	x	x	Australia	1982
	40 ppm	x	x		New Zealand	1971
	50 ppm	d	d		India	-
	50 ppm	g	g		United Kingdom	1953
	100 ppm	x	x	x	Chile	1982
	100 ppm	x	x		Zambia	1976

p - in protein
e - except where natural levels are higher
c - in metal containers
l - in liver
g - recommended guideline
d - dry weight basis
r - revised limit (proposed)

Table C-3

Median International Standards for Trace Elements in Freshwater Fish and Marine Shellfish

Element	Median Standard (ppm) Fish	Shellfish	Range	Number of Countries with Standards
Antimony	1.0	1.0	1.0 to 1.5	3
Arsenic	1.5	1.4	0.1 to 5.0	11
Cadmium	0.3	1.0	0.05 to 2.0	10
Chromium	1.0	1.0	1.0	1
Copper	20	20	10 to 100	8
Fluoride	150	-	150	1
Fluorine	17.5	-	10 to 25	2
Lead	2.0	2.0	0.5 to 10	19
Mercury	0.5	0.5	0.1 to 1.0	28
Selenium	2.0	0.30	0.30 to 2.0	3
Tin	150	190	50 to 250	8
Zinc	45	70	40 to 100	6

* Based on: Nauen, C. C., Compilation of Legal Limits for Hazardous Substances in Fish and Fishery Products, Food and Agriculture Organization of the United Nations, 1983.

these international standards. In the absence of U.S. standards for toxic metals other than mercury, these international standards can be used as reference values against which the SMW results can be evaluated.

Because these international standards were established on a fresh weight (wet weight) basis, the SMW results must be converted from dry weight values to wet weight values before comparisons with international standards can be made. Using the technique described earlier, the SMW data was therefore converted to a wet weight basis, and compared with the median international standards listed in Table C-3. Certain SMW samples exceeded the median international standards for cadmium, arsenic, lead, zinc, and chromium. These findings are discussed in the following sections.

Arsenic and Cadmium: More than half of all SMW samples were found to exceed the median international standard of 1.0 ppm, wet weight for cadmium. Also more than half of all SMW samples analyzed for arsenic were found to exceed the median international standard of 1.4 ppm, wet weight for arsenic. High concentrations of cadmium and arsenic were found statewide, and were not restricted to mussels collected in isolated areas or locations along the coast. California mussel concentrations of cadmium and arsenic are thus quite high compared to shellfish standards set by many nations throughout the world.

This finding is quite surprising. Perhaps California's ocean waters contain naturally elevated levels of cadmium and arsenic. It is also possible that the California mussel (Mytilus californianus) accumulates these metals to a greater degree than other species of shellfish. It may be desirable to sample other marine fishery products from California waters to determine if cadmium and arsenic levels are consistantly elevated, or if high concentrations of cadmium and arsenic are restricted to the California mussel.

Chromium: About three percent of the SMW samples contained chromium concentrations that exceeded the median international standard of 1.0 ppm, wet weight. Single samples exceeding 1.0 ppm, wet weight, were found in Monterey Harbor, Bodega Head, and Catalina Island. Two elevated samples were found in Los Angeles Harbor. Three samples with high chromium levels were taken from near Diablo canyon and San Luis Harbor. Four such samples were found from the Palos Verdes Peninsula area near Royal Palms. Lastly, four elevated samples were collected from Humboldt Bay. For a discussion of the elevated chromium concentrations found in Humboldt Bay, see Section 3.3.2 of this report.

Lead: About ten percent of the SMW samples contained lead concentrations that exceeded the median international standard of 2.0 ppm, wet weight. Almost all of these samples were found either in the Monterey Harbor area or in southern California. Samples taken from the Monterey Harbor area consistantly contained lead concentrations that exceeded the median international standard. One sample from this area was found to have a lead concentration of 250 ppm.

of 2.0 ppm wet weight, making this area second only to the Monterey Harbor area in the degree of lead contamination present. As clams and other marine organisms are harvested in this area for sport purposes and for human consumption, additional efforts should be made to determine possible sources and control measures for the very high lead levels found here.

A single sample from Colorado Lagoon, Los Angeles County, also contained very high concentrations of lead. As clams have also been harvested from this area for human consumption, follow-up efforts are needed here to determine possible sources and control measures for the identified lead contamination.

Lead concentrations in excess of 2.0 ppm wet weight were also found in the Los Angeles Harbor area, near Catalina Island, in Anaheim Bay, at Corona del Mar, La Jolla, and San Diego Bay. Less frequently, high lead concentrations have also been found at Newport Bay, Royal Palms, Mission Bay, and the Farallon Islands. With the exception of the single Farallon Island sample, and the samples from the Monterey Harbor area, all of the samples found to exceed 2.0 ppm lead, wet weight, were found in southern California, in, or south of Los Angeles. Table C-4 lists the areas and numbers of samples found to exceed 2.0 ppm lead, wet weight, and the approximate range of lead concentrations detected. The data suggest that fallout from air pollution may cause or contribute to the elevated lead concentrations found in southern California. Future monitoring in this area should indicate if a reduction in lead levels in mussels results from the reduction in the use of lead in gasoline that is presently occurring.

Table C-4

Lead Levels Exceeding 2.0 ppm, Wet Weight in Mussels

Area	No. Samples Exceeding 2.0 ppm Lead, Wet Weight	Approximte Range of Elevated Lead Concentrations (ppm, wet weight)
Monterey Harbor Area	13	2-250
Marina del Rey-El Segundo Area	9	2-12
Colorado Lagoon	1	9-10
Los Angeles Harbor Area	7	2-8
Catalina Island	7	2-4
Corona del Mar	4	2-3
Anaheim Bay	3	2-3
San Diego Bay	3	2-3
La Jolla	3	2-3
Newport Bay	2	2-3
Royal Palms (Palos Verdes Peninsula)	2	2-3
Mission Bay	1	2-3
Farallon Islands	1	2-3

Zinc: About one percent of the SMW samples contained Zinc concentrations in excess of the median international standard of 70 ppm, wet weight. These samples were found only in the San Diego Bay area, the Los Angeles Harbor area, and the Monterey Harbor area. These results are discussed in more detail in the individual sections of the report dealing with the respective site-specific surveys.

The highest concentrations of zinc were found in and near Monterey Harbor, and were associated with high lead concentrations. Efforts now underway to control the high lead concentrations in this area (Section 3.3.6) may also reduce the elevated concentrations of zinc now found there.

Appendix D. State Mussel Watch Protocol: Procedural Guidelines for Sampling, Analyzing and Reporting Trace Metal and Synthetic Organic Concentrations in Marine Mussels.

1.0 INTRODUCTION

The following procedures for sampling, processing and measuring trace metals and synthetic organic compounds in marine mussels are employed in the California State Mussel Watch Program. For the most part these procedures are derived from seven years of monitoring mussels from California coastal marine waters (Stephenson et al., 1978, 1979, 1980 and 1982; Risebrough et al., 1980; Martin et al., 1980, 1982) and from the recommendations of the International Mussel Watch Program (Goldberg, 1980). These guidelines are intended for implementation in routine environmental monitoring programs.

The need for procedural consistency in environmental monitoring programs has been emphasized by various investigators (Flegal, 1982; Patterson et al., 1976; American Chemical Society (anon.), 1970; Hunter, 1980) and, specifically for "Mussel Watch" studies, by Goldberg, 1980, and Stephenson et al., 1980. Analyses of tissues in different laboratories has resulted in trace metal values differing by 1000-fold. These discrepancies in reported concentrations can be attributed to the use of widely differing techniques. (Patterson, et al., 1976; Topping and Holden, 1978; Flegal, 1982; Brix et al., 1983). Use of standardized methodologies, proper quality control procedures, and intercalibrations among laboratories facilitates comparability of data.

2.0 GUIDELINES FOR SAMPLING DESIGN

2.1 SAMPLING DESIGN FOR RESIDENT MUSSELS

2.1.1 APPROXIMATELY 100 MUSSELS SHOULD BE COLLECTED AT EACH STATION AND DIVIDED EQUALLY BETWEEN THE TRACE METAL AND SYNTHETIC ORGANIC ANALYTICAL GROUPS.

In order to calculate the minimum sample size required for differentiation of mean concentrations of toxicants in mussels, it is necessary to have estimates of the true population (concentration) mean and variance for each pollutant studied at each site (Gordon et al., 1980). Using the procedure of Dixon and Massey (1969), one can calculate the sample size required to detect a statistically significant difference between two means which differ by a given amount. This practice entails the individual analyses of many mussels from each of the sites being monitored. Gordon et al. (1980a), evaluated sample size with respect to population variance. They demonstrated that for aluminum, cadmium, copper, chromium, iron, lead, nickel, and zinc, a sample size of between 30 and 50 mussels is adequate for detection of 20-30% differences between population means.

For studies which undertake the monitoring of many sites, this practice may be too expensive. Therefore, in order to reduce the number of analyses, the pooling of many individuals into a single, composite analytical sample is an accepted practice (Fuge and James, 1973; Montgomery et al., 1976; Goldberg et al., 1978). In most trace metal studies which take measures to ensure adequate quality control, variability attributable to analytical and sampling techniques is small compared with the inherent variability present in a given population of mussels (Gordon et al., 1980; Stephenson et al., 1977). Pooling permits a good estimation of the population mean with a substantial reduction in analytical effort.

The International Mussel Watch (Goldberg, 1980) recommends, as a minimum, a single analytical sample of 20 composited individuals for trace metals. Likewise, Risebrough et al., (1980), determined that a sample composite of 40 is necessary to ensure that sampling variance is considerably less than the analytical variance for chlorinated hydrocarbons. Based on these findings, the California State Mussel Watch samples 45 mussels from each site to be monitored. For trace metals, three analytical replicates of 15 individuals are analyzed from each site. Cost prohibits the program from analyzing more than one replicate of 20 to 100 composited individuals for synthetic organic compounds. In this case, archiving replicate samples (undissected mussels) is invaluable for verifying findings and suspicious data at a later date.

2.1.2 FOR MONITORING PURPOSES, THE USE OF MUSSELS BETWEEN 55 AND 65 MM IN LENGTH IS RECOMMENDED

Tissue concentrations of certain trace metals and organic compounds show a distinct correlation with the size of mussels analyzed. (Bryan and Uysal, 1978; Boyden, 1974, 1977). With the exception of mercury, concentrations of trace elements decrease with increasing mussel size. These correlations are not consistent from element to element and appear to vary with such factors as season (Phillips, 1976), species (Boyden, 1974), and presence of other elements (Boyden, 1974; Phillips, 1976). Synthetic organic concentrations, found primarily in the lipid component of mussel tissue, do not appear to follow this; thus, they are not greatly affected by mussel size (Goldberg, 1980). For monitoring purposes, mussels of 55 to 65 mm in length should be collected to reduce size-related effects (Goldberg, 1980).

2.1.3 MUSSELS SHOULD BE COLLECTED FROM THE HIGHEST TIDAL HEIGHT WHERE THEY OCCUR IN SUFFICIENT NUMBERS

Habitat height (i.e., height with respect to mean low tide) can be another source of within site variability. It has been shown to be correlated with metal levels in Perna canaliculas (Nielsen, 1974), M. californianus (Stephenson et al., 1979) and M. edulis (Phillips, 1976). This variable should be studied further. In an attempt to minimize variability induced by habitat height, mussels of the proper size are collected from the highest tidal height where they occur in sufficient numbers.

2.1.4 MYTILUS EDULIS OR M. CALIFORNIANUS ARE RECOMMENDED AS SUITABLE MONITORING ORGANISMS FOR TRACE ELEMENTS AND SYNTHETIC ORGANIC COMPOUNDS

Several marine bivalve species have been used successfully as biological pollutant monitors. The California Mussel, Mytilus californianus, is recommended for studies conducted on the west coast of the United States where it is found ubiquitously on the exposed outer coast. In addition, it is easily transplanted to bays and estuaries (Stephenson et al., 1980). Alternatively, the bay mussel, *M. edulis*, can be used in bays and estuaries, as this species is endemic to these habitats. Furthermore, circumglobal distribution of *M. edulis* in temperate latitudes is another factor which makes this species a good choice for pollutant monitoring.

2.1.5 SAMPLING FREQUENCY SHOULD BE DESIGNED FOR THE PARTICULAR FOCUS OF THE STUDY

General macro-scale monitoring should occur annually similar to other "Mussel Watch" programs (Stephenson *et al.*, 1982; Goldberg *et al.*, 1978). Constraints placed on sampling by seasonal variation of trace metals in bivalves may dictate more frequent sampling (Goldberg, 1980). More frequent sampling is also in order at study sites characterized by periodic inputs of pollutants. This is particularly important when monitoring point source discharges and/or seasonal surface water runoff.

2.1.6 DEPURATION OF MUSSELS MAY BE NECESSARY WHEN SUCH SEDIMENT RELATED ELEMENTS AS IRON, ALUMINUM, MANGANESE AND CHROMIUM ARE OF PRIMARY CONCERN

Gut sediment and fullness have been shown to influence the concentrations of these elements present in mussels (Gordon *et al.*, 1980b; Stephenson *et al.*, 1979; Ouellette, 1978). However, due to the potential for contamination, when elements other than iron, aluminum, manganese and chromium are of interest, depuration is not recommended. Depuration is unnecessary for halogenated organic compounds (Goldberg, 1980).

2.2. SAMPLING DESIGN FOR TRANSPLANTED MUSSELS

2.2.1 TRANSPLANTING OF BIVALVES SHOULD OCCUR IF MUSSELS OF THE DESIRED SIZE RANGE DO NOT INHABIT THE AREA OF CONCERN OR DEFINITE SPATIAL ARRAYS OF STATION PLACEMENTS (I.E. VERTICAL AND HORIZONTAL) ARE NEEDED TO MONITOR POINT SOURCE DISCHARGES

Transplanting may also be desirable to provide an indication of current water quality conditions in areas where existing resident populations are already contaminated (i.e., due to previous pollutant conditions).

2.2.2 TRANSPLANT STOCK IS COLLECTED FROM SITES DISTANT FROM POLLUTANT EXPOSURE

The California State Mussel Watch obtains its transplant stock from Trinidad Head, Bodega Head and Montana de Oro. Samples are also collected for immediate analysis to serve as pretransplant controls. The mussels are polyethylene bags before being brought to the surface. Upon return to shore, the transplants are then triple bagged using the procedures discussed in Sections 3.1.3 and 3.1.4. The outer sample bag should contain the following information, using permanent black marking pens: identification numbers, description of site, program identification, date of collection, species, and type of analysis to be performed.

2.2.4 TRANSPLANTS SHOULD BE DEPLOYED FOR AN INTERVAL OF AT LEAST TWO MONTHS BUT PREFERABLY FOR SIX MONTHS

In most cases, a two month transplant period is adequate where the uptake rates are expected to be high. For trace metals in less contaminated environments, a six month interval may be necessary for resolution between sites (Stephenson et al., 1980). If complete trace metal equilibrium is desired between transplanted and native stocks of mussels, a much longer transplant period should be used, especially when monitoring some metals such as silver (Stephenson et al., 1979). Shorter periods are required for petroleum hydrocarbons and halogenated organics. Complete equilibrium for these compounds appears to be on the order of 90 days (Fossato and Canzonier, 1976; DiSalvo et al., 1975). The California State Mussel Watch uses transplant intervals of from 4-6 months, consistent with transplant periods for trace metals. Shorter transplant periods, however, would probably be adequate. Care must be taken when comparing mussel samples of differing transplant durations; comparison is not recommended for elements such as silver, copper and lead.

2.2.5 SHALLOW WATER TRANSPLANT STATIONS ARE ESTABLISHED IN AREAS ACCESSIBLE TO SCUBA DIVERS

The transplant system used for shallow water (up to about 90 m depth) consists of a buoy system constructed with a screw-in type earth anchor, 5/8 inch polypropylene line and a twelve inch diameter inflatable subsurface float (Figure D-1). In some cases, mussel transplants may be hung on polypropylene line from a pier. Creosote-coated wooden piers, however, should be avoided as they are potentially contaminating.

2.2.6 THE MUSSELS TO BE TRANSPLANTED ARE PLACED IN NYLON MESH BAIT BAGS APPROXIMATELY 3 INCHES (76 mm) WIDE BY 30 INCHES (760 mm) LONG WITH 1/2 INCH SQUARE MESH

The bags are washed with detergent and rinsed with deionized water prior to use. The mussels are added to the bags in groups of 7-8 individuals. The groups are separated from each other by knotting the bag or otherwise constricting the bag through the use of nylon cable ties (Figure 1). This arrangement permits nearly equal water exposure for all the mussels. Nylon cable ties are also used to tie off and attach the bait bags to the buoy system.

3.0 GUIDELINES FOR SAMPLE COLLECTION AND HANDLING

3.1 COLLECTING RESIDENT MUSSELS

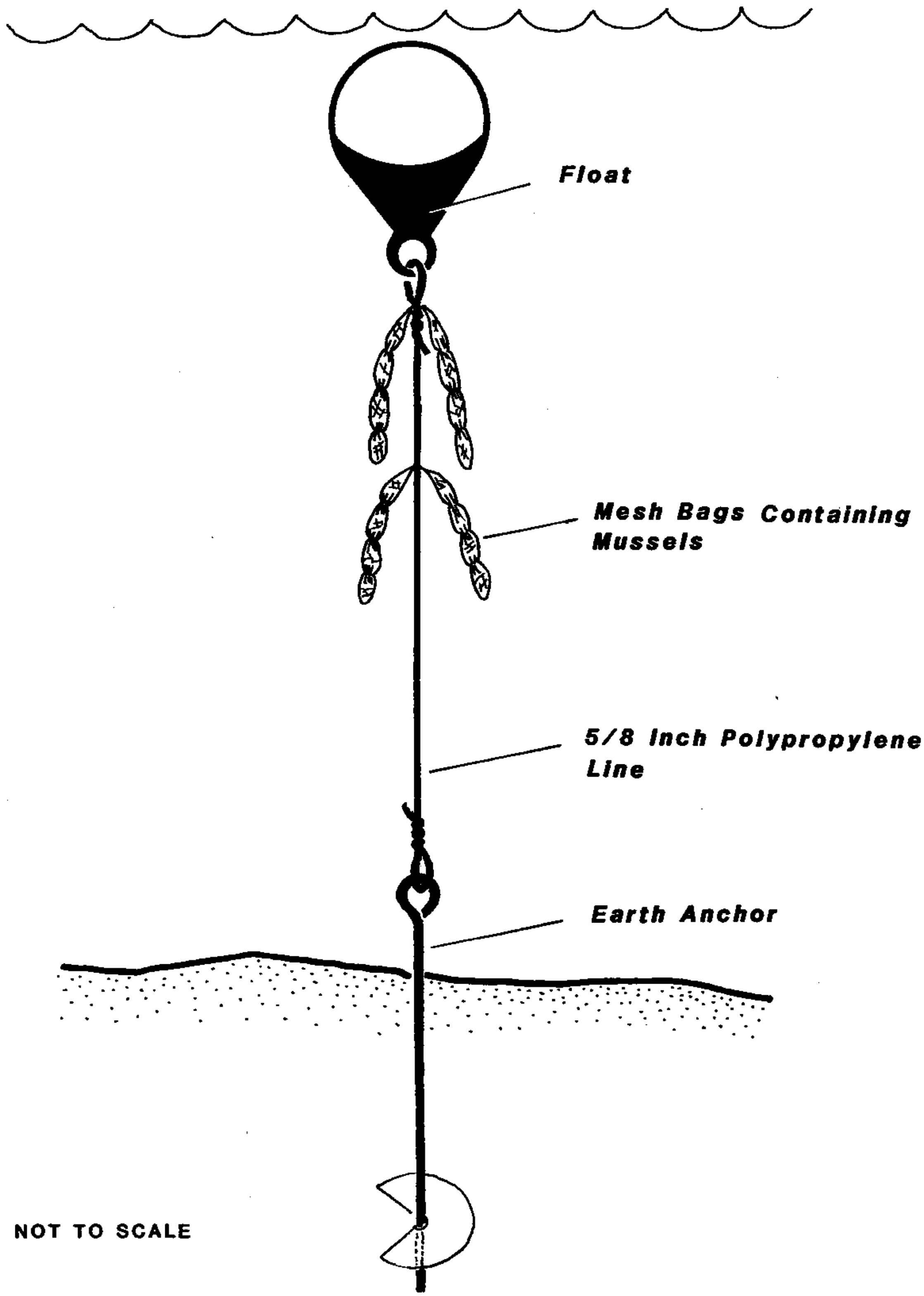

Figure D-1 DIAGRAM OF THE TRANSPLANT SYSTEM DEPLOYED IN CALIFORNIA BAYS AND ESTUARIES

3.1.1 POLYETHYLENE GLOVES SHOULD BE WORN WHEN COLLECTING AND PROCESSING MUSSEL SAMPLES

Every effort should be made to minimize contamination caused by handling the mussel samples.

3.1.2 MUSSELS SHOULD BE COLLECTED FROM ROCKS WITH STAINLESS STEEL PRY BARS

Contamination from use of stainless steel tools has been shown to be insignificant (Grooves, 1977). The pry bars should be cleaned with Micro^{R}, a detergent cleaning solution, and rinsed thoroughly with tap water. Pry bars should be rinsed again at the field site with ambient seawater.

3.1.3 THE MUSSELS TO BE ANALYZED FOR TRACE ELEMENTS ARE PLACED IN A ZIPLOCK POLYPROPLYLENE BAG (4 MIL THICKNESS)

The bag should be cleaned with MICRO^{R}, a detergent, followed by thorough rinses of deionized water. The sample is then placed inside two additional polypropylene ZIPLOCK^{R} bags.

3.1.4 THE MUSSELS TO BE ANALYZED FOR SYNTHETIC ORGANICS ARE PLACED IN AN ALUMINUM FOIL BAG

[illegible]

soon after collection as possible. Twenty-four hour depuration periods appear to be adequate for such sediment associated elements as iron, aluminum and manganese (Ouellette, 1978).

4.0 LABORATORY PREPARATION OF MARINE MUSSELS FOR CHEMICAL ANALYSIS

4.1. TRACE ELEMENTS

4.1.1 TO MINIMIZE CONTAMINATION, SAMPLES ARE PROCESSED UNDER "CLEAN ROOM" CONDITIONS

The need for "clean rooms" for trace metal analytical work has been established by Patterson _et al_ ., (1976). However, the stringent criteria proposed by these authors would preclude all but a few laboratories from analyzing samples for trace metals. Acceptable, yet more easily met criteria from Flegal (1982) are recommended. "Clean room" shoes and coats are worn in the laboratory. The trace metal laboratory has no metallic surfaces, with benchtops, sinks and fume hoods constructed of acid resistant plastic to avoid metal contamination. A filtered air supply (class 100) which provides a positive pressure clean air supply is an important feature for reducing contamination from particulates.

4.1.2 THE FOLLOWING CLEANING PROCEDURE FOR PLASTICWARE AND GLASSWARE IS RECOMMENDED:

1. Soak in Micro^R detergent for 3 days.
2. Rinse throughly with tap water, followed by deionized water.
3. Soak in 6N HCl (reagent grade) for 3 days.
4. Rinse 6 times with Milli Q^R water (deionized 18 megaohm).
5. If glasssware is used, it should be soaked for three days in 7 _N_ reagent grade HNO_3, followed by thorough rinsing with Milli Q^R water.
6. Soak in Milli Q^R water for 3 days.
7. Rinse in Milli Q^R water.
8. Oven or air dry in a covered polyethylene container which has been cleaned with Micro^R and thoroughly rinsed with deionized and Milli Q^R water.

4.1.3 THE FOLLOWING PROCEDURE IS EMPLOYED FOR MUSSEL DISSECTION AND HOMOGENATION:

Frozen mussels are removed individually from the ZIPLOCK^R bags, cleaned of attached organisms and debris under running deionized water by personnel wearing polythylene gloves. Samples are allowed to thaw in clean polyethylene trays. The adductor muscle is severed and the gonad removed with a Micro^R cleaned, stainless steel scalpel. The remainder of the soft part is placed in a preweighed, acid-cleaned, polypropylene 4 oz jar and reweighed. The shell lengths are also taken, in addition to notation of any visible growth by transplanted mussels. The samples are placed in an acid-cleaned Pyrex homogenizing flask and homogenized for three minutes in a Virtis-45^R homogenizer equipped with a specially fabricated titanium shaft. The pure titanium shaft and blade eliminate possible sample contamination by most elements resulting from blade erosion. The shaft and blade, cleaned in hot HNO_3 and rinsed with deionized water, contribute an insignificant amount of trace metal contaminants (Stephenson et al .m 1979). Samples to be analyzed for titanium may require separate homogenizing using stainless steel blade and shaft. The homogenized samples may then be refrozen at -20° until analysis.

4.1.4 GONADS ARE EXCLUDED FROM TRACE ELEMENTS ANALYSIS

The concentrations of some trace metals (copper, lead and zinc) in Mytilus californianus vary with organism sex (Alexander and Young, 1976; Gordon et al ., 1978) and mass of gonad (Ouellette, 1978). The California State Mussel Watch Program has historically excised and excluded the gonads from the trace metal analyses in an attempt to minimize this variability. The choice to exclude the gonads had been based on the large tissue weight difference between ripe, unspawned mussels and mussels just after spawning. The gonad weight may account for as much as 25% of the total tissue weight depending on sexual maturity (Ouellette, 1978). Furthermore, Simpson (1979) suggests that correlations of metal concentrations (lead, zinc) with mussel tissue weight may be closely tied to reproductive cycles. Until this poorly understood relationship is better studied, gonad removal is mentioned here as an optional practice.

4.2. SYNTHETIC ORGANIC COMPOUNDS

4.2.1 THE PROCESSING OF MUSSELS FOR SYNTHETIC ORGANIC ANAYSES SHOULD BE CONDUCTED UNDER CONDITIONS WHERE CONTAMINATION RISKS (i.e. DUST, EXHAUST) ARE MINIMAL

4.2.2 RECOMMENDED CLEANING PROCEDURES FOR EQUIPMENT AND GLASSWARE USED IN SYNTHETIC ORGANIC ANALYSES ARE AS FOLLOWS:

1. Wash in hot, soapy water.
2. Rinse throughly in tap water and deionized water.
3. Rinse with glass distilled methanol.
4. Rinse with glass distilled petroleum ether.

4.2.3 MUSSELS ARE DISSECTED AS FOR TRACE ELEMENTS (Sections 4.1.3 and 4.1.4) EXCEPT THE GONADS ARE INCLUDED IN THE ANALYSIS

The dissection is conducted on a sheet of hexane-rinsed aluminum foil and the soft parts are placed in a cleaned glass jar.

4.2.4 THE SAMPLES ARE HOMOGENIZED IN THE SAME MANNER AS THE TRACE ELEMENT SAMPLES

A stainless steel shaft and blade may be substituted for the titanium blade and shaft used for trace element samples. The samples are then stored frozen at -20°C until extraction and analysis.

5.0 ANALYTICAL PROCEDURES

5.1. TRACE ELEMENTS

5.1.1 FOR MERCURY DETERMINATIONS, THE FLAMELESS ATOMIC ABSORPTION TECHNIQUE IS ADAPTED FROM STAINTON (1971)

The sample (0.5-1g wet weight) plus 3 ml of a 2:1 mixture of concentrated H_2SO_4 and HNO_3 in a 20 ml stoppered glass test tube, is digested at 50°C in a water bath for 3 hours. After cooling, 6 ml of 6% $KMnO_4$ are added gradually and the sample is allowed to react for 12-18 hours. Then an additional 1 ml of 6% $KMnO_4$ is added to ensure oxidation. Samples are then cleared with a few drops of 30% H_2O_2, followed by back titration with 6% $KMnO_4$ until the samples turn pink. 2 ml of sample, 2 ml of reductant and 6 ml of air are aspirated into a 10 ml syringe. The syringe is capped and its contents mixed on a vortex mixer for 10 seconds. The mercury vapor is then injected into a 15 cm borosilicate glass cell fitted with silica end windows. The cell is locked into the light path of an atomic absorption spectrophotometer equipped with a strip chart recorder. Either a mercury hollow cathode or mercury vapor lamp may be used. The latter requires its own power source but gives a better signal to noise ratio (Stainton, 1971). The reductant consists of 600 ml of trace metal free water, 100 ml of H_2SO_4, 5 g NaCl, 10 g $(NH_2OH)\ 2H_2\ SO_4$ and 20 g of $SnSO_4$. This is prepared in the order given, and diluted to 1000 ml with Milli Q[R] water. It must also be made up fresh daily.

5.1.2 ALUMINUM, CADMIUM, CHROMIUM, COPPER, IRON, LEAD, MANGANESE, NICKEL, SILVER AND ZINC DETERMINATIONS REQUIRE THE FOLLOWING TISSUE DIGESTION PROCEDURE.

A 3 to 5 g wet weight aliquot is placed in a 30 ml beaker and dried at 70°C for 72 hours. The samples are protected from contamination while in the oven by being placed in a Micro[R] cleaned polyethylene container covered with 3 layers of Assembly Wipes[R]. The dried samples are weighed and 5ml of 70% redistilled HNO_3 is added to each. The HNO_3 is prepared by redistilling G. Frederick Smith or Baker Instranalyzed[R] distilled HNO_3 with a quartz, subboiling distillation still. The purity of acid produced using this technique is justified by Kuehner <u>et al</u>., 1972. The sample is refluxed for 3 hours, taken slowly to dryness, followed by charring at 350° C to decompose lipids. The sample is then redissolved in 5 ml of redistilled HNO_3. Further oxidation is accomplished by dropwise addition of 30% H_2O_2. Following this step, the sample is taken to near dryness and redissolved in 20 ml of 1% HNO_3 in Milli Q[R] water. The solution may then be transferred to a cleaned 30 ml conventional polyethylene vial.

5.1.3 THE INSTRUMENTAL ANALYSIS OF THE TISSUE DIGESTS FOR TRACE METALS IS PERFORMED VIA ATOMIC ABSORPTION SPECTROPHOTOMETRY

It is recommended that mercury be analyzed using the atomic absorption, cold vapor technique described by Stainton (1971). Lead, silver, chromium and nickel are analyzed with a Perkin Elmer[R] 603 atomic absorption spectrophotometer, equipped with a background corrector and either a graphite furnace or a carbon rod analyzer. Lead concentrations are determined by standard addition. Flame absorption spectrophotometry (air-acetylene) is used for cadmium, copper, manganese, zinc and iron. Aluminum is analyzed with a nitrous oxide acetylene flame. Other analytical techniques have also been used successfully and are acceptable providing an adequate quality assurance program is conducted. Detection limits for the trace metal analyses are presented in Table 1 in Section 2.0 of the main report.

5.2. SYNTHETIC ORGANIC COMPOUNDS

5.2.1 THE MUSSEL HOMOGENATE SAMPLES ARE EXTRACTED FOR SYNTHETIC ORGANIC COMPOUNDS ACCORDING TO PROCEDURES OF THE FOOD AND DRUG ADMINISTRATION (1970)

A 50 g wet weight sample is blended for 2 minutes with 200 ml acetonitrile in a glass, high speed blender with stainless steel blades. The homogenized sample is then filtered with suction through an 8 cm Buchner funnel fitted with a prewashed Whatman[R] #42 filter paper into a 500 ml separatory funnel. After the addition of 50 ml of petroleum ether, the separatory funnel is shaken vigorously for one to two minutes. 5 ml of saturated NaCl solution and 300 ml H_2O are added and the separatory funnel is mixed vigorously while in a horizontal position for 30-45 seconds. The layers are then allowed to separate and the aqueous phase is discarded. The remaining solvent layer is then gently washed with two 50 ml portions of water. The washes are discarded and 40 ml of the solvent layer is transferred to a glass stoppered graduate cylinder. To this, 3 gm of anhydrous Na_2SO_4 are added and the mixture is shaken vigorously. It is important not to allow the sample to remain with the Na_2SO_4 for longer than one hour as losses of organochlorine pesticides may result. The solution is transferred directly to a Florisil column.

The Florisil columns are prepared as follows: A small wad of glass wool, pre-extracted with petroleum ether, is placed at the bottom of a 22 mm internal diameter (I.D.) glass column to retain the Florisil. The column is packed with four inches (after settling) of activated Florisil and topped with 1/2 inch of anhydrous Na_2SO_4. The column is prewetted with petroleum ether. A Kuderna-Danish concentrator with a graduated collection vessel is placed under the column to receive the eluate. The petroleum ether solution of sample extract is added to the column. The walls of the sample vessel are rinsed with two 5 ml rinses of petroleum ether. These rinses are transferred to the ether. Receiving vessels are changed and the column is further eluted with 200 ml each of 6% and 15% ethyl ether/petroleum ether at about 5 ml/min. Each eluate is then concentrated to 5 ml in the Kuderna-Danish concentrator and Snyder column, and 5 ml of iso-octane is added.

The concentrates are analyzed by electron capture detection. Table D-1 gives the distribution of synthetic organic compounds among the three fractions of a standard Florisil column.

TABLE D-1 Distribution of synthetic organic compounds among the three fractions of a standard Florisil[R] column.

(0%) Fraction[1]	(6%) Fraction[2]	(15%) Fraction[3]
HCH-alpha[4]	benefin (Benfluralin)	2,4-D isobutyl ester
	HCH-alpha	2,4-D isopropyl ester
cis-chlordane	HCH-beta	2,4-D n-butyl ester
chlordene, alpha	HCH-gamma	dacthal
chlordene, gamma	HCH-delta	diazinon
op'DDE	carbophenothion	dieldrin
pp'DDE	CDEC (Vegedex)	endosulfan I (Thiodan I)[5]
pp'DDMU	chlorbenside	endrin
op'DDT	cis-chlordane[4]	fenitrothion
pp'DDT[4]	trans-chlordane	nitrofen (TOK)
heptachlor	chlorpyrifos	parathion, ethyl
hexachlorobenzene[4]	op'DDD	parathion, methyl
mirex	pp'DDD	tetradifon (Tedion)
trans-nonachlor[4]	pp'DDE[4]	
PCB 1242	pp'DDMS	
PCB 1248	pp'DDT	
PCB 1254	dichlofenthion	
PCB 1260	dicofol (Kelthane)	
	endosulfan I (Thiodan I)[5]	
	ethion	
	fonofos (Dyfonate)	
	heptachlor epoxide	
	hexachlorobenzene (HCB)[4]	
	methoxychlor	
	trans-nonachlor[4]	
	oxychlordane	
	PCNB (quintozene)	
	perthane	
	phenkapton	
	phorate (Thimet)	
	ronnel	
	strobane	
	toxaphene	

[1] 0% ethyl ether in petroleum ether
[2] 6% ethyl ether in petroleum ether
[3] 15% ethyl ether in petroleum ether
[4] In both 0% and 6% fractions.
[5] In both 6% and 15% fractions.

5.2.2 THE ANALYSIS OF THE TISSUE CONCENTRATES FOR SYNTHETIC ORGANIC COMPOUNDS IS PERFORMED BY ELECTRON CAPTURE DETECTION CAPILLARY GAS CHROMATOGRAPHY

Synthetic organic determinations are made with a Varian^{R} 3700 gas chromatograph equipped with a 30 m, 0.25 mm I. D. SE-54 fused silica capillary column and a CDS-111(c) Data System. A 30 m, 0.25 mm I. D. SE-30 glass capillary column is used for second column verification. All compounds reported are coinjected wth standards on one or both of the columns. All samples are run isothermally using a Nickel ^{63} electron capture detector under the following conditions:

	SE-54	SE-30
Injector Temperature	210°C	210°C
Column Temperature	194°C	190°C
Detector Temperature	290°C	290°C

Nitrogen is used as the carrier gas at a linear velocity of 25 cm/sec. The column temperature is adjusted to maintain a constant relative retention time of 1.81 for p,p' DDE, relative to aldrin on the SE-54 column. The carrier gas linear velocity is adjusted to maintain a constant absolute retention time.

For quality control purposes, 10% of the samples are analyzed in duplicate. All materials and reagents contacting the sample after initial extraction are analyzed for organic contamination. Detection limits for frequently monitored compounds are presented in Table 1 in Section 2.0 of the main report.

5.2.3 PENTACHLOROPHENOL ANALYSES ARE PERFORMED FOLLOWING THE PROCEDURES OF LEW (1983)

5.3. LIPID DETERMINATION

5.3.1 SINCE SYNTHETIC ORGANIC CONCENTRATIONS IN ORGANISMS VARY WITH THE LIPID CONTENT OF THE TISSUES ANALYZED, IT IS CUSTOMARY TO PROVIDE LIPID DATA WHEN REPORTING TISSUE CONCENTRATIONS

A thoroughly homogenized sample weighing approximately 5 g (wet weight) is dried and macerated with anhydrous granular Na_2SO_4. The dried sample is transferred to a blender with 150 ml of petroleum ether and blended for 2 minutes at high speed. The liquid is filtered with suction through a 10 cm. Buchner funnel containing Whatman #42 filter paper into a 500 ml filter flask. The sample is blended once more with an additional 100 ml of petroleum ether and filtered. The filtrate is concentrated to approximately 25 ml with heat (steam bath) and air. The remaining filtrate is then quantitatively transferred into a 50 ml preweighed planchet. The petroleum ether is evaporated off, the planchet containing the residue is reweighed, and the percent lipid is calculated.

6.0 REPORTING PRODEDURES

6.1. REPORTING POLLUTANT DATA

6.1.1 POLLUTANT DATA ARE REPORTED ON A DRY WEIGHT BASIS

At present, most trace metal data are presented on a dry weight basis, as this practice appears to somewhat decrease the inherent variability component (see Goldberg, 1980). In addition, for synthetic organic compounds, it is desirable to report values on a lipid basis or to provide data on the lipid content of the samples.

Quality assurance is best achieved through the analysis of standard reference materials and laboratory intercalibration of exchanged samples. For trace

1. National Bureau of Standards: SRM 1571-orchard leaves, SRM 1577-bovine liver, and SRM-oyster

2. Environmental Research Laboratory, (South Ferry Road, Narragansett, Rhode Island 02882) - mussel tissue.

The results of these analyses along with the certified values are to be presented with the monitoring data. A measure of analytical variability and detection limits should also be presented for each element and tissue type. If no reference materials are available for comparison, intercalibration with an outside laboratory, preferably employing an independent method, is advisable.

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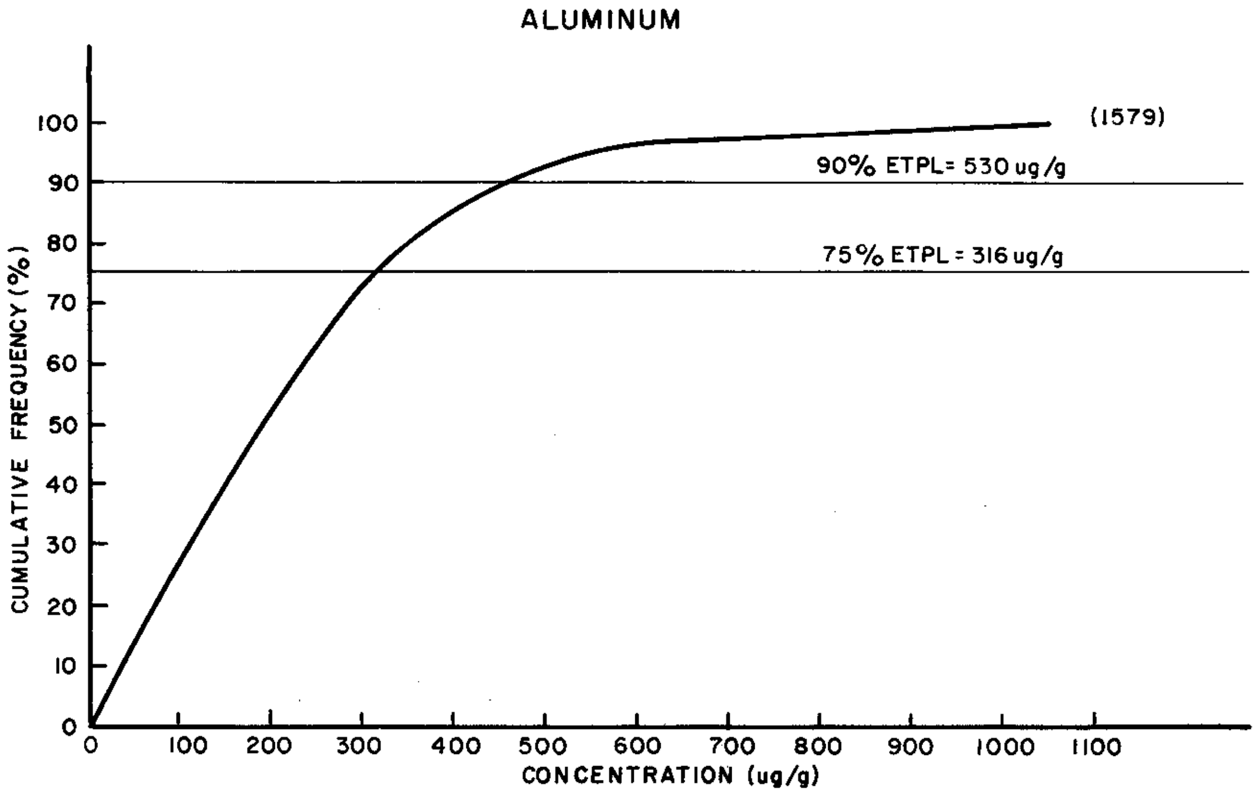
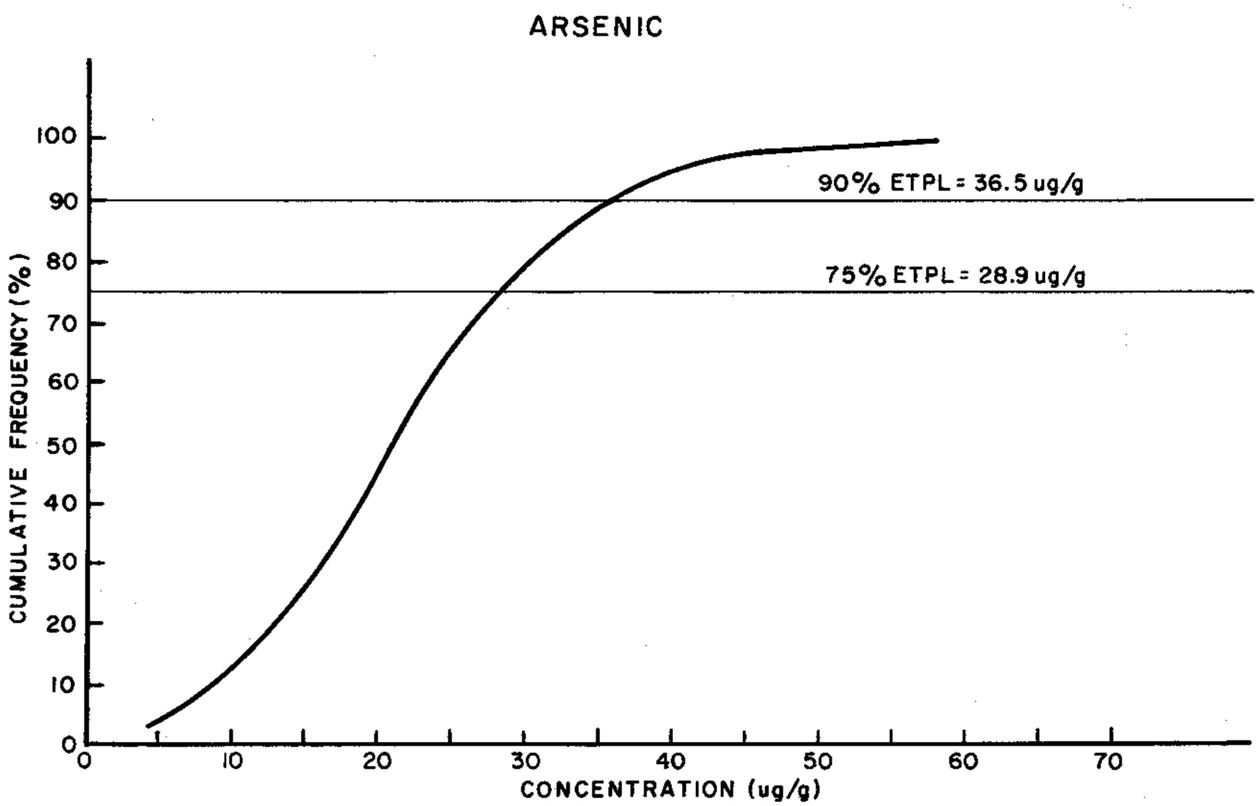
APPENDIX E

ELEVATED TOXIC POLLUTANT LEVELS

This year, the elevated toxic pollutant level (ETPL) concept has been made an integral part of the SMW Report. The derivation and use of the ETPL number for a particular pollutant is described in Section 3.1. This report appendix contains plots of the cumulative frequency distribution versus concentration for selected trace metals and synthetic organic compounds monitored by the SMW program. ETPLs for resident California mussels (RCM) and transplanted California mussels (TCM) are plotted separately. Availability of sufficient data was the usual constraint which served to limit the number of ETPLs which could be plotted. This was particularly true for synthetic organic compounds where enough data was not always available to produce a readable graph.

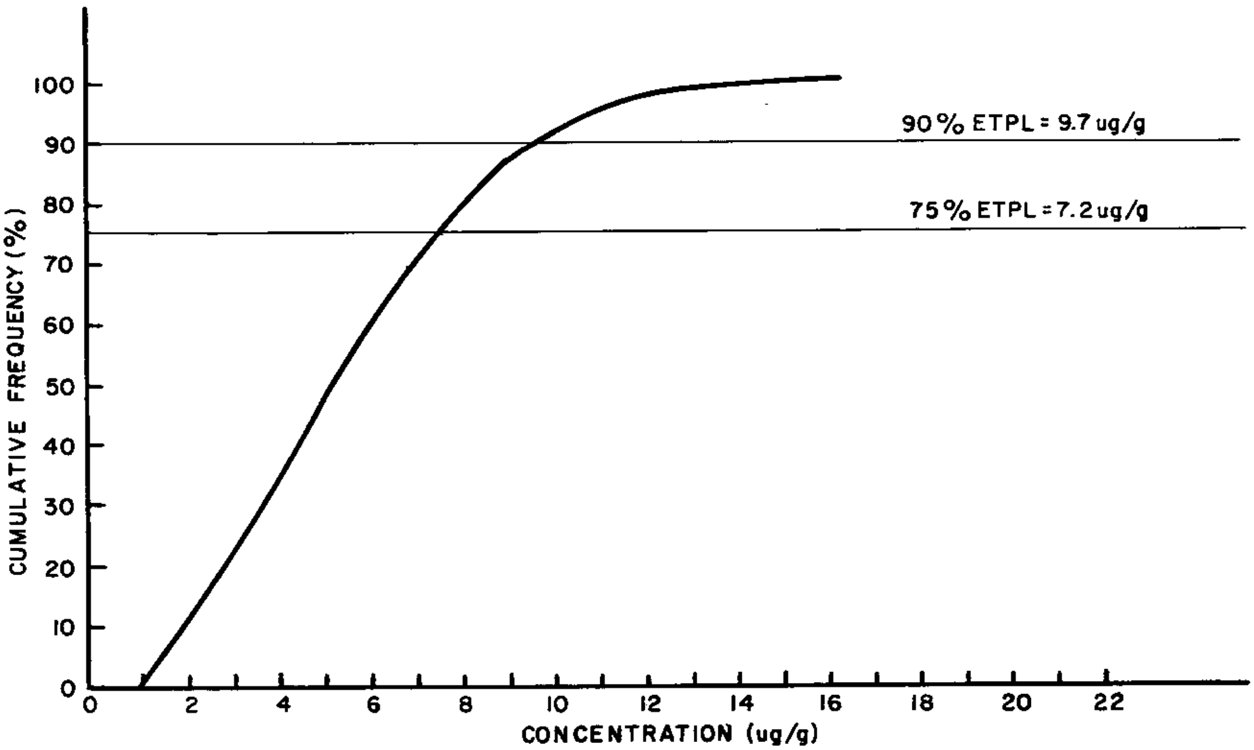
These plots can be used to relate the concentration of a toxic substance at a particular station with the range and distribution of that substance's concentrations found in all other samples of the same type. For ease of use, the ETPL 75 and the ETPL 90 are shown on each plot. The ETPL 75 (upper quartile value) is the value below which 75 percent of all tissue concentrations of that substance have been found. This represents in this report a "highly elevated" concentration. Similarly, the ETPL 90 (upper decile value) is the value below which 90 percent of all observed concentrations lie. This represents in this report a "very highly elevated" concentration. When a value exceeds an ETPL 90, some follow-up investigation is usually warranted and recommended. This is one of the major advantages of the ETPL concept. By comparing values to other values found in California, it is possible to quickly isolate cases where "normal background levels" for a given substance have been grossly exceeded. This allows the SMW program and cooperating Regional Boards to concentrate resources on investigating the most serious situations.





DISTRIBUTION OF ALUMINUM AND ARSENIC CONCENTRATIONS IN RESIDENT CALIFORNIA MUSSELS

CADMIUM



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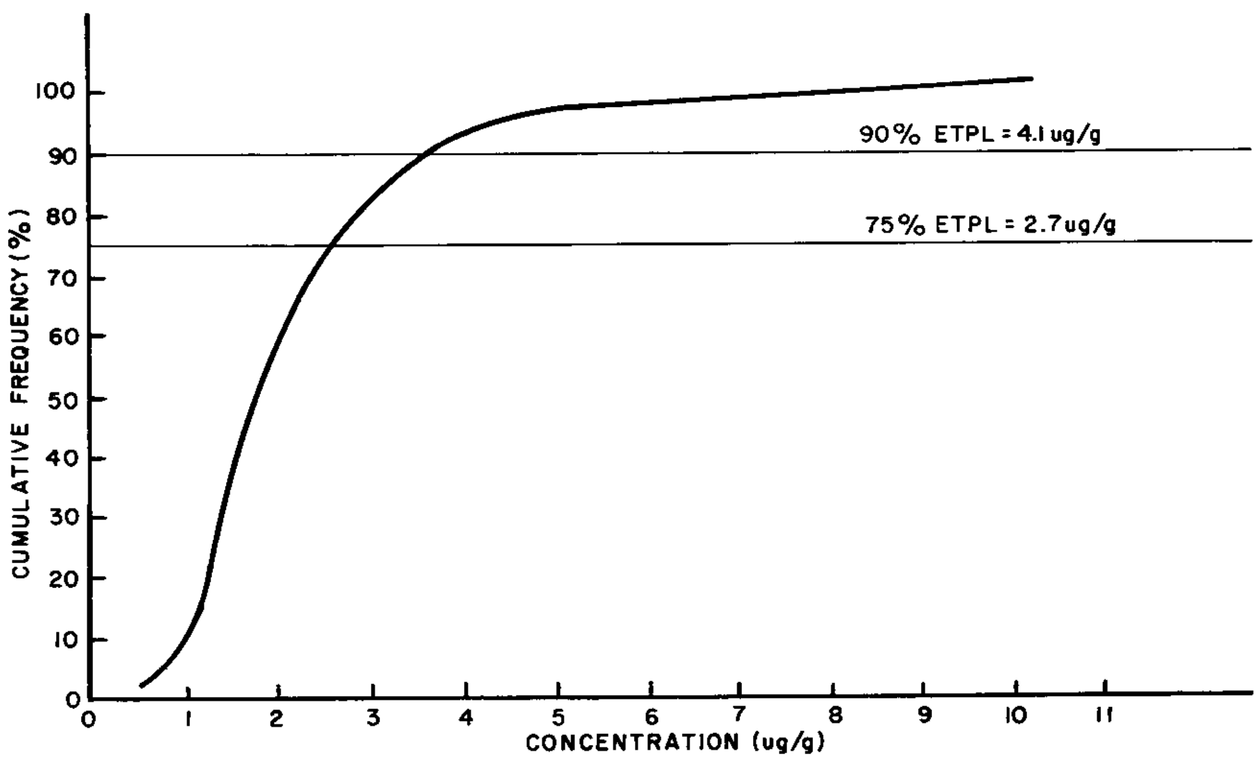
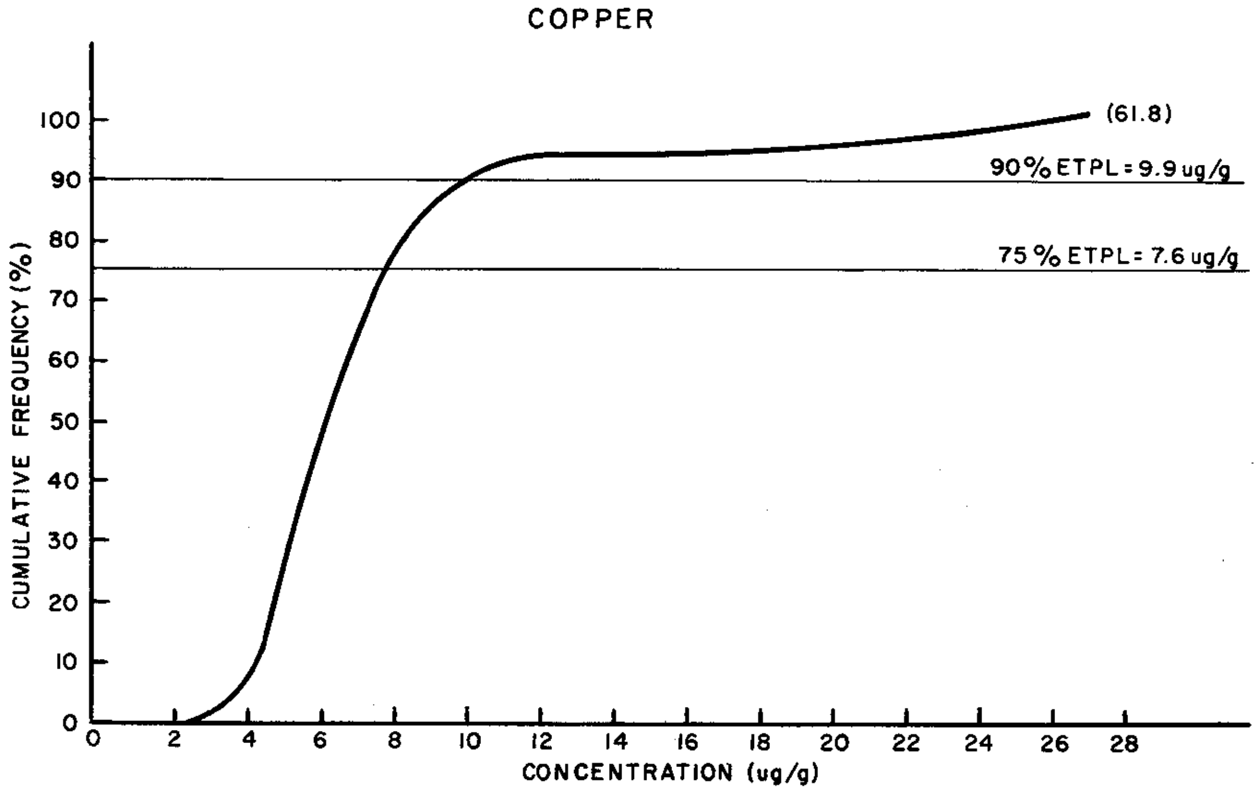
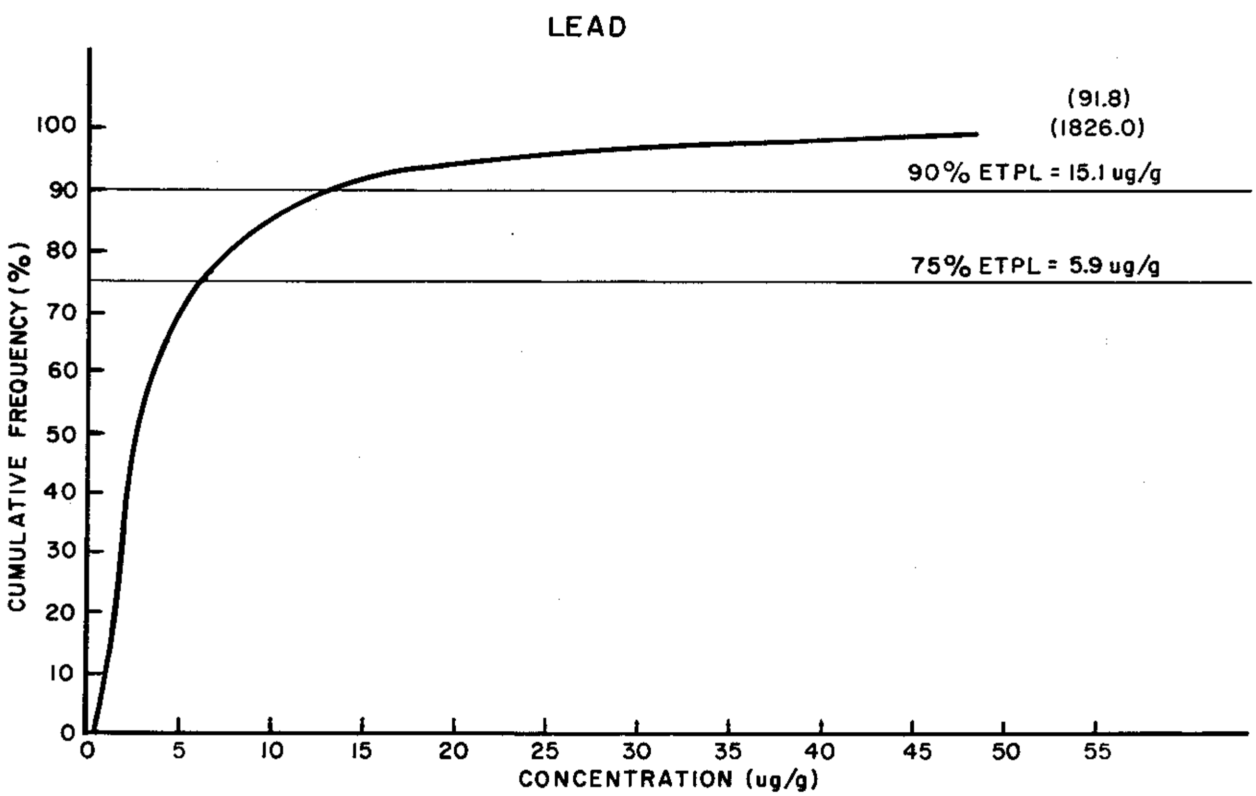


DISTRIBUTION OF CADMIUM AND CHROMIUM CONCENTRATIONS IN RESIDENT CALIFORNIA MUSSELS





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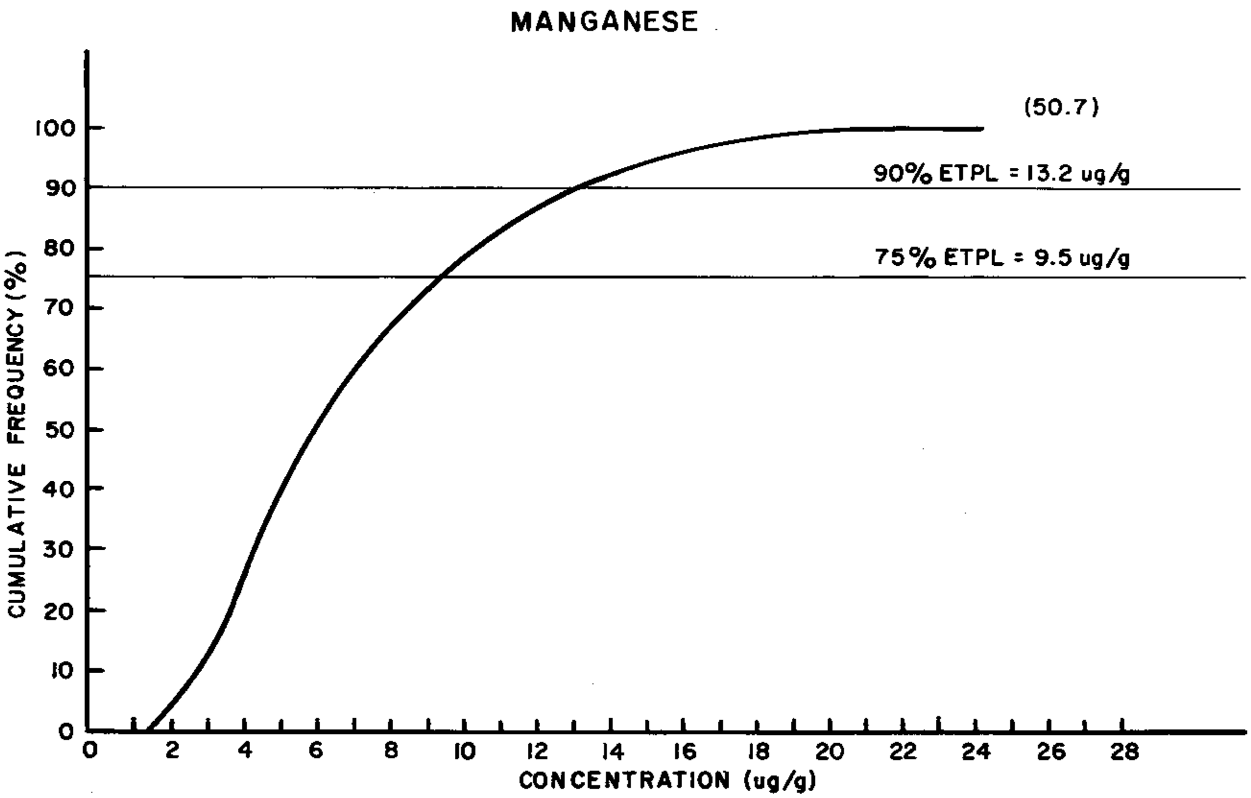

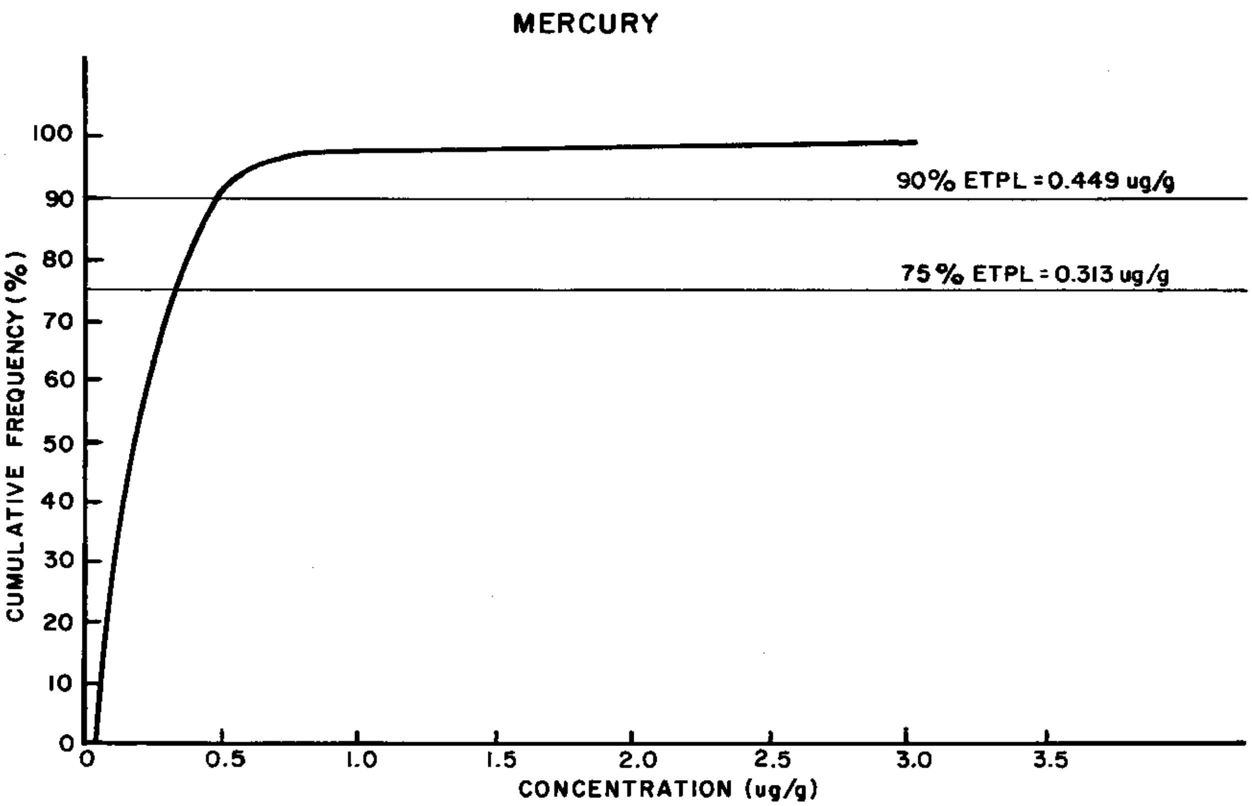

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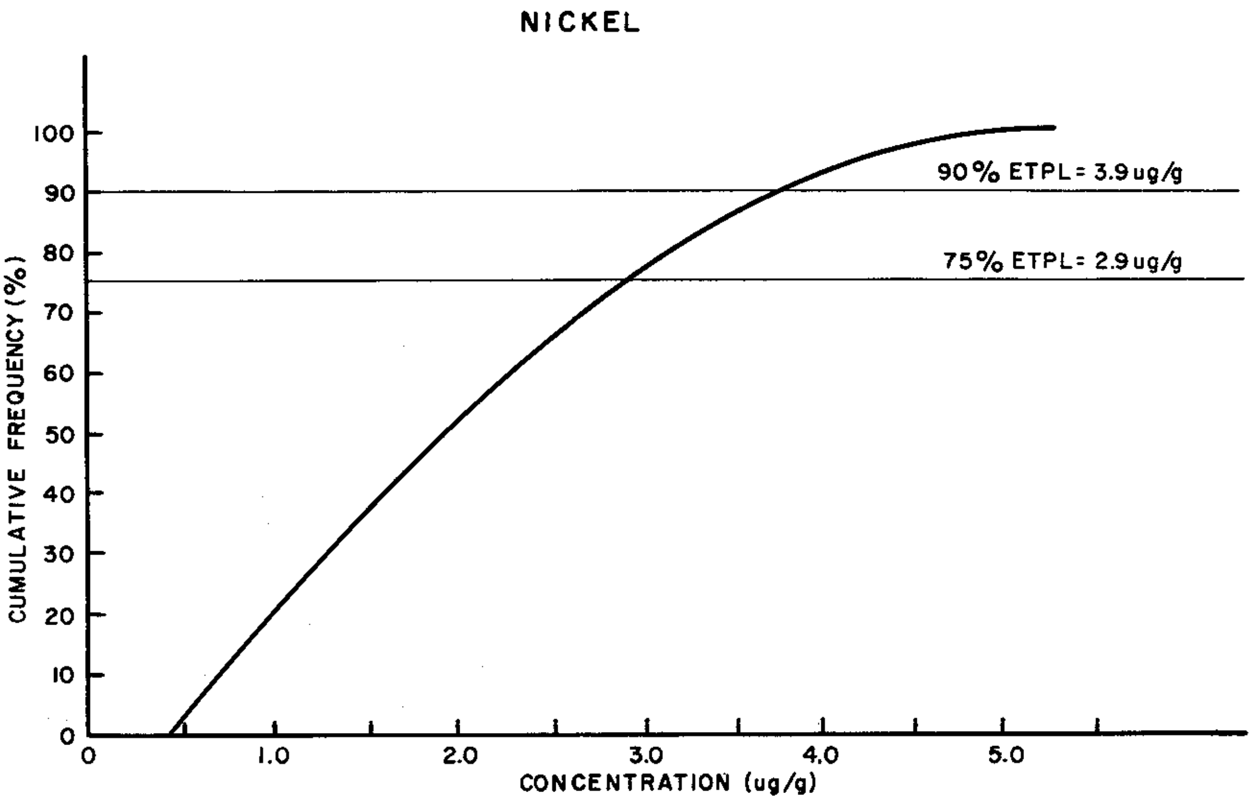

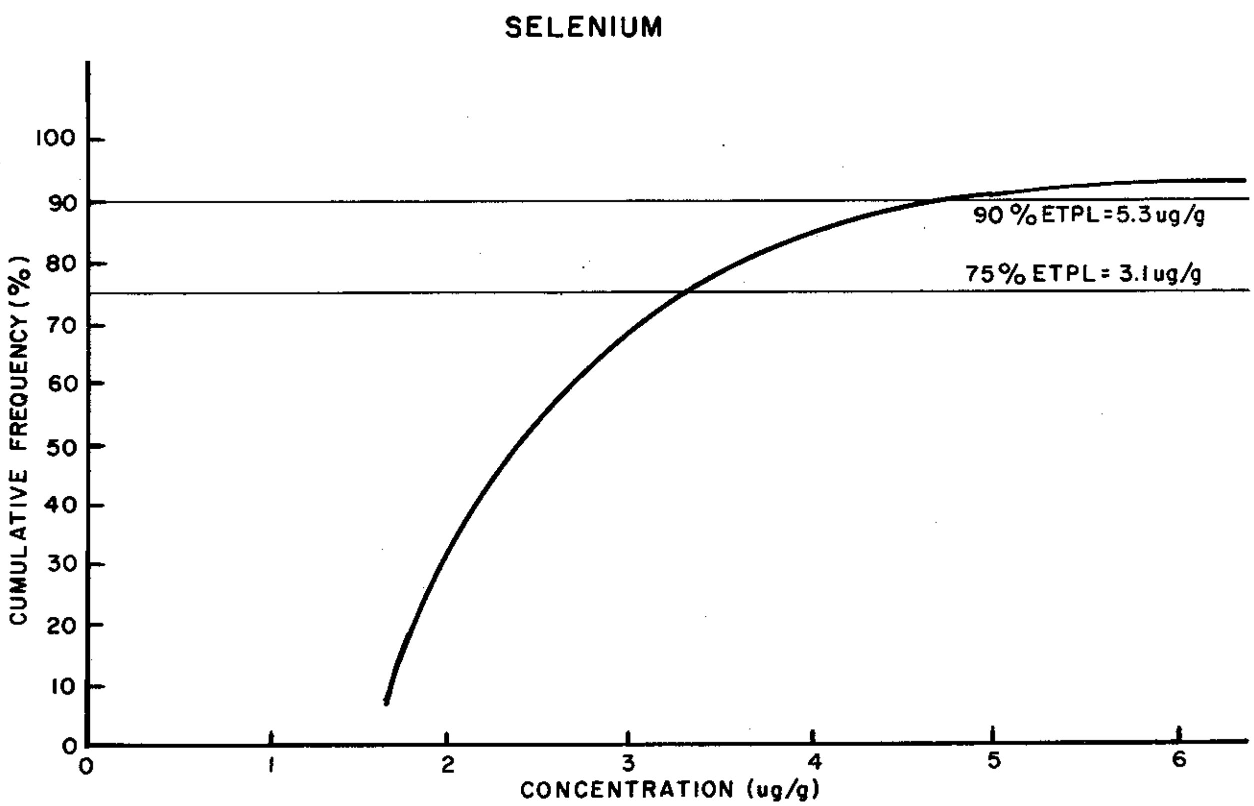

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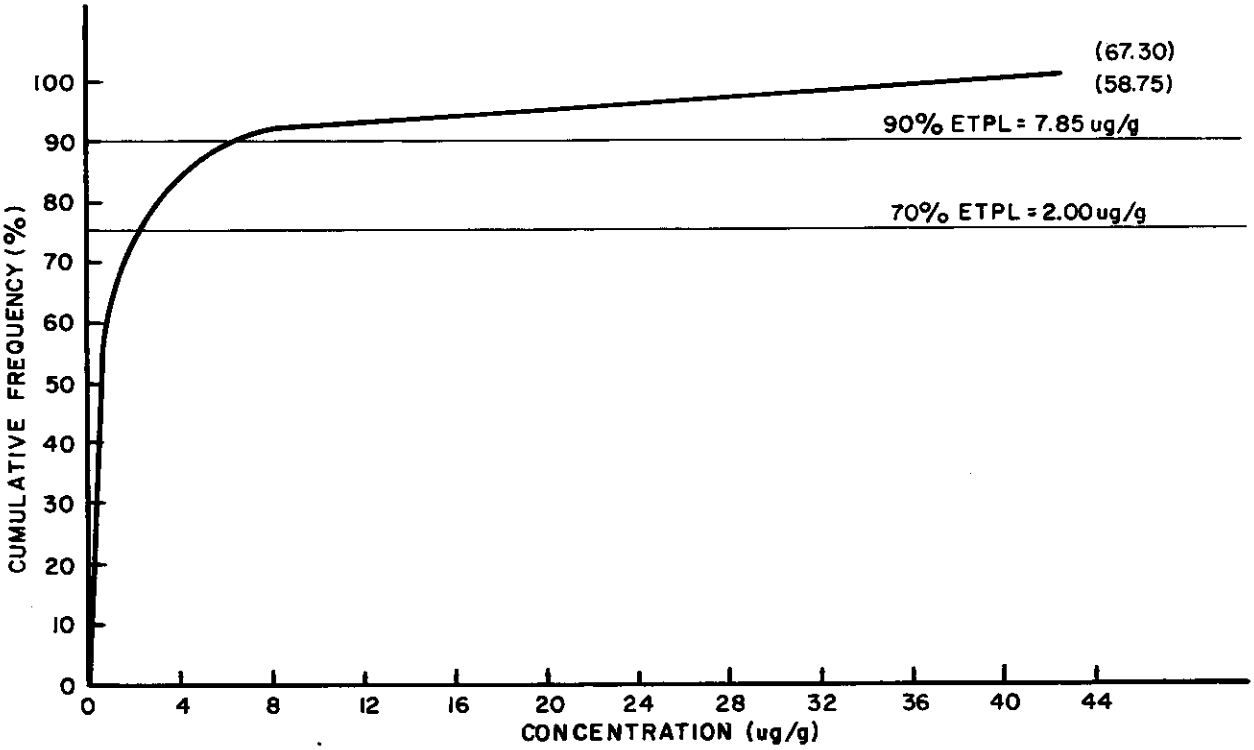

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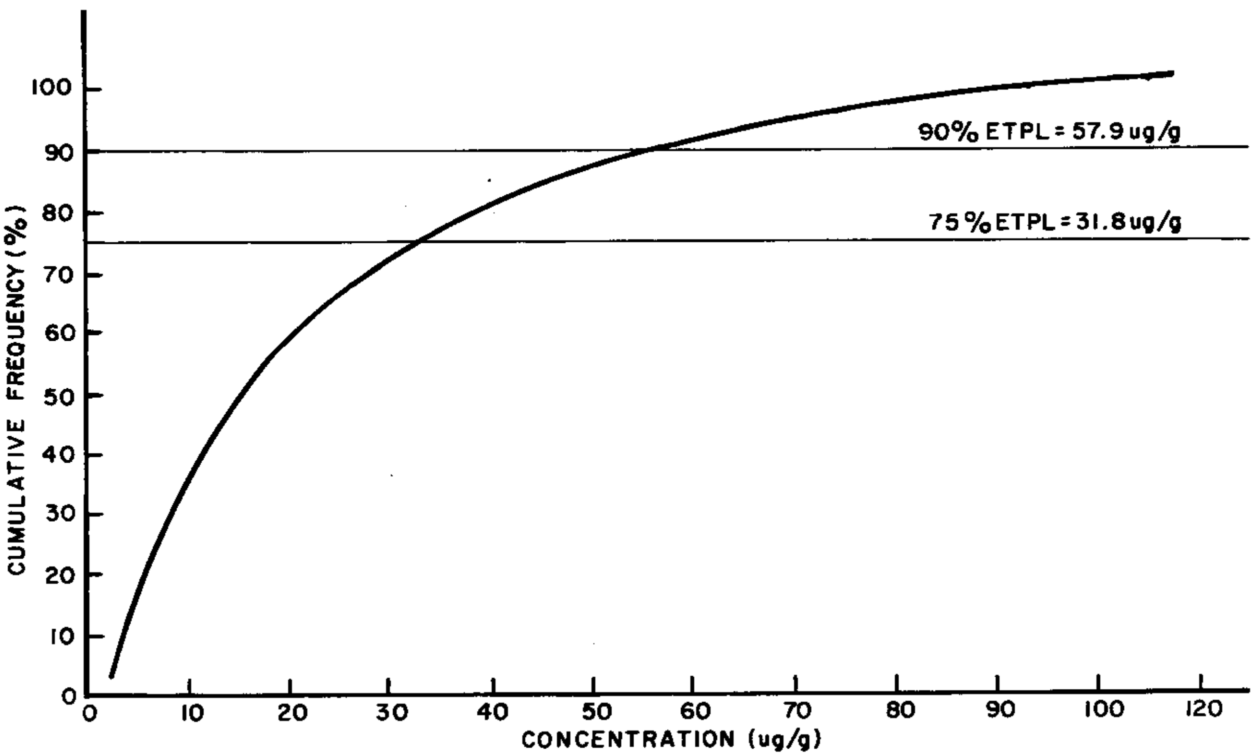

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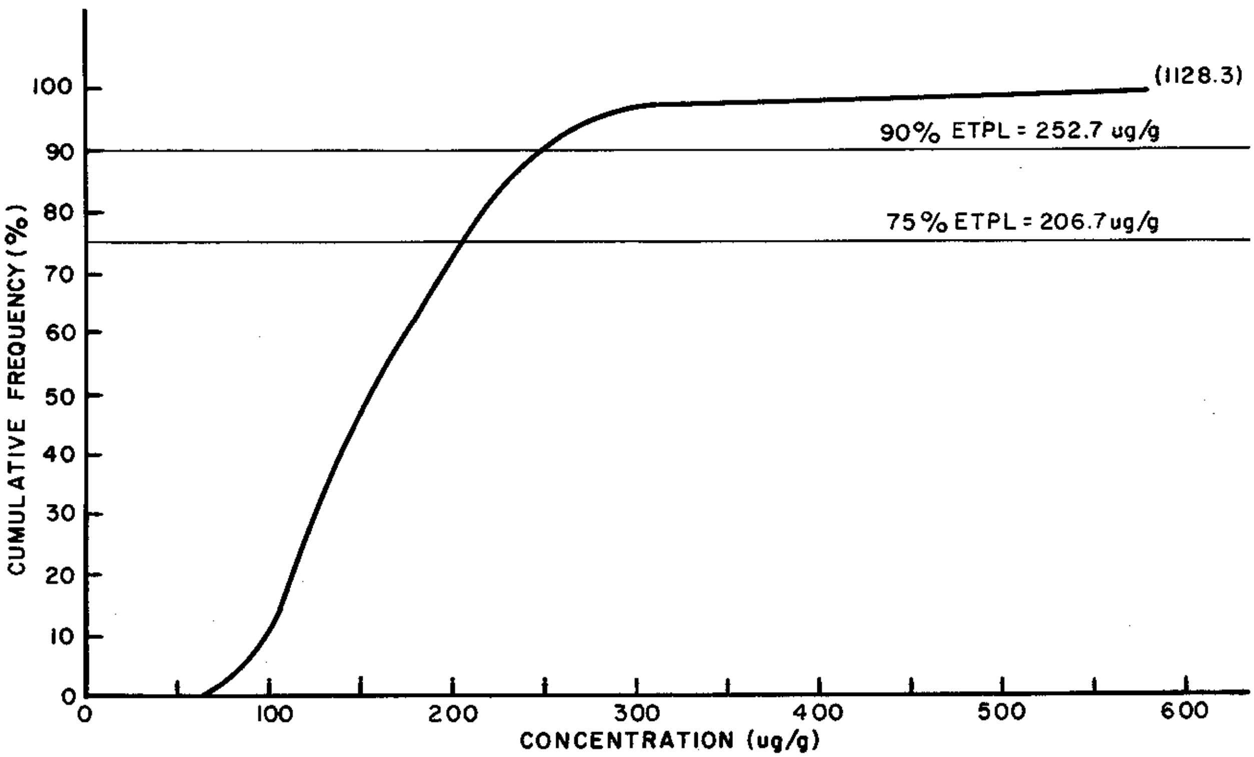

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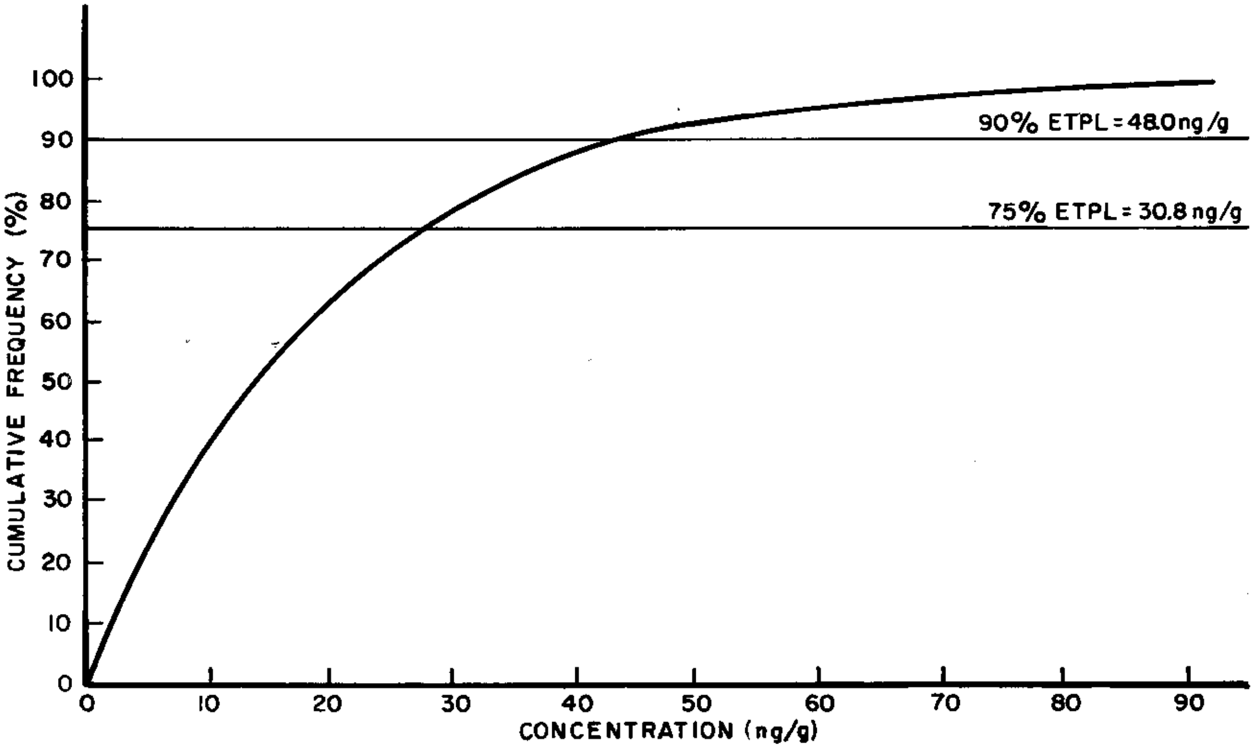
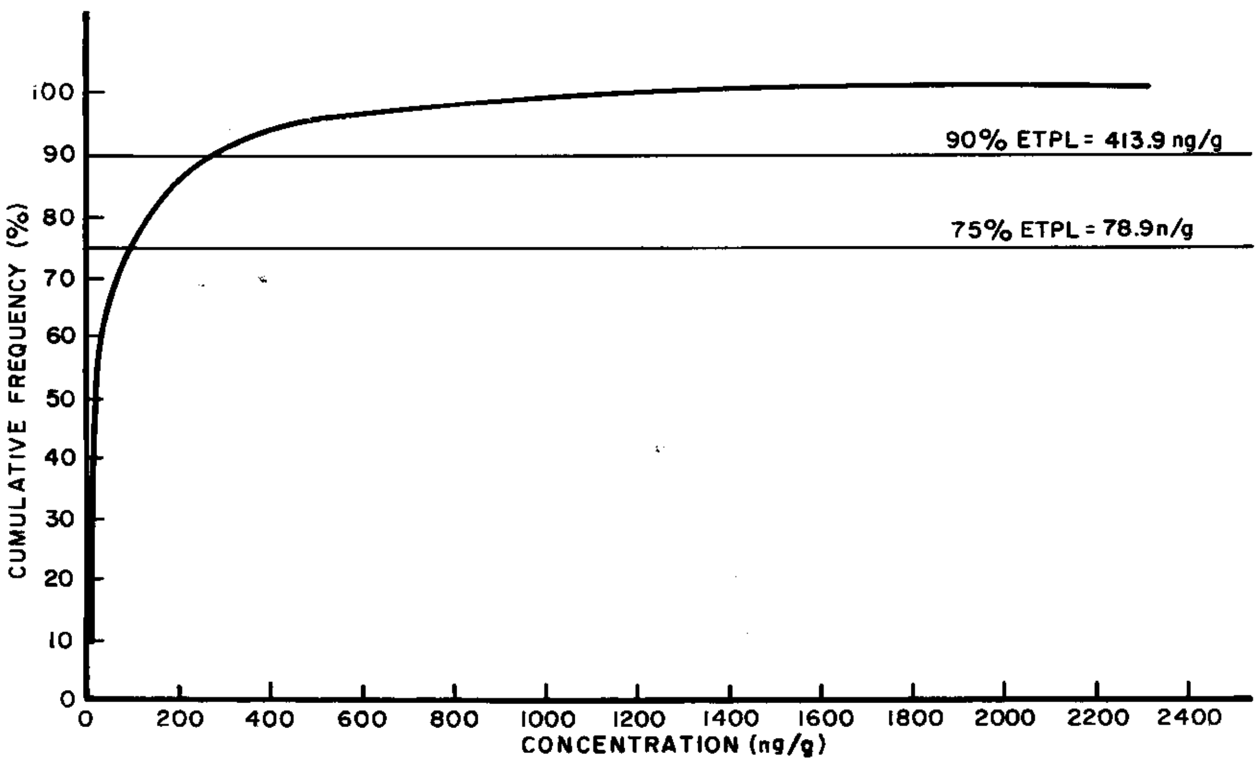
CHLORDANE



DDT



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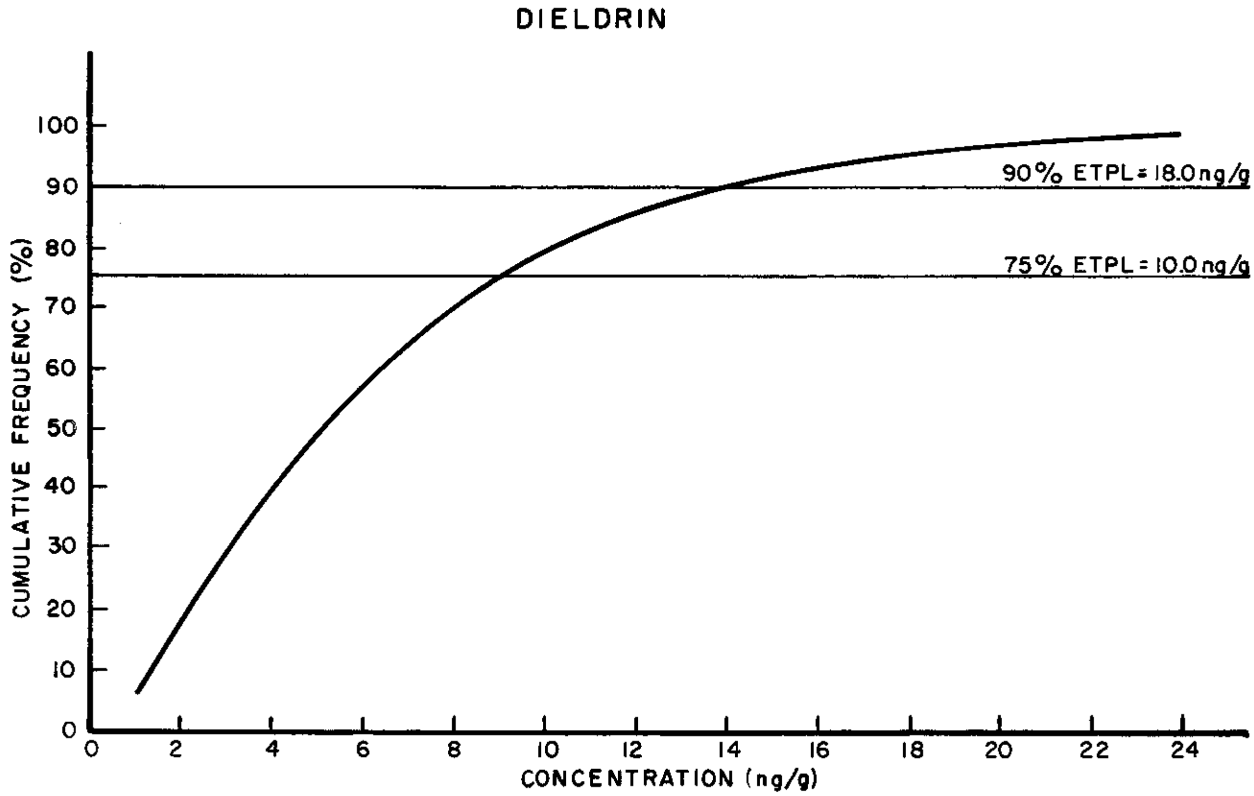

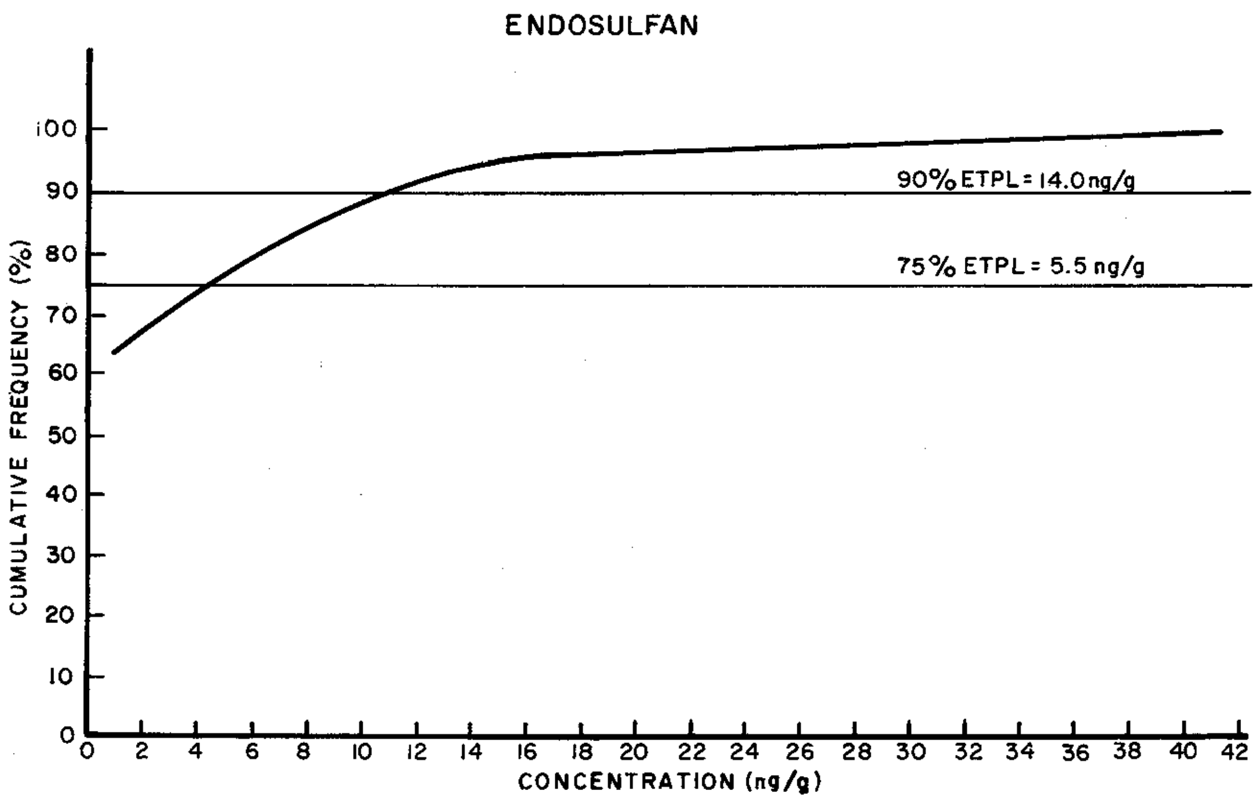

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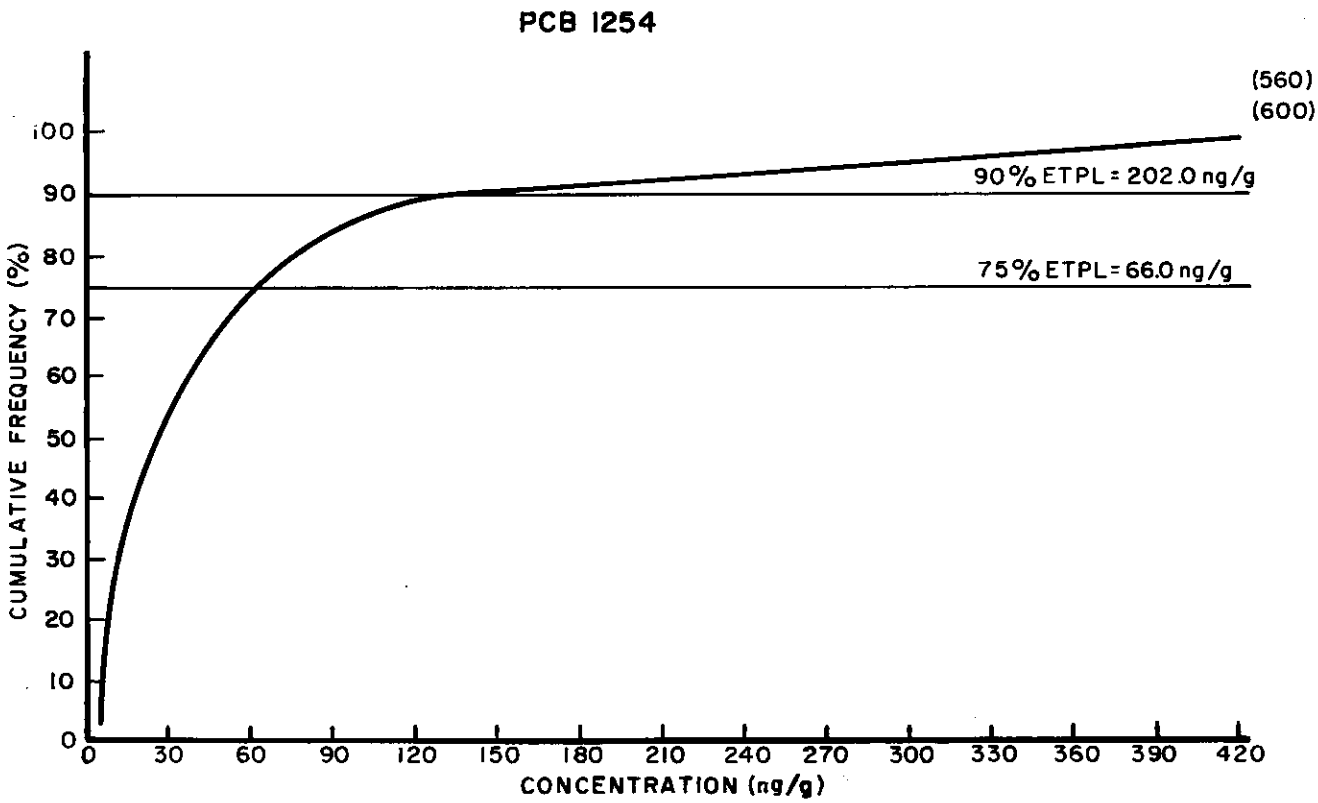

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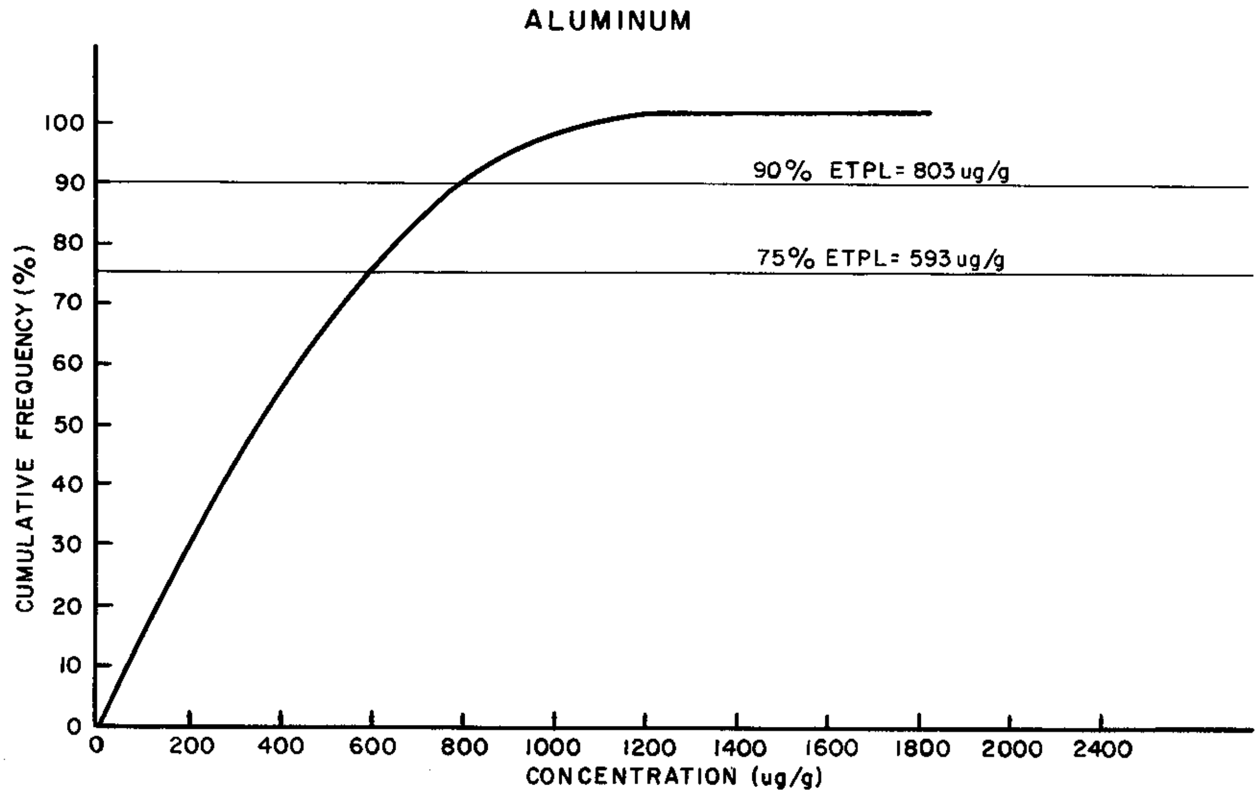

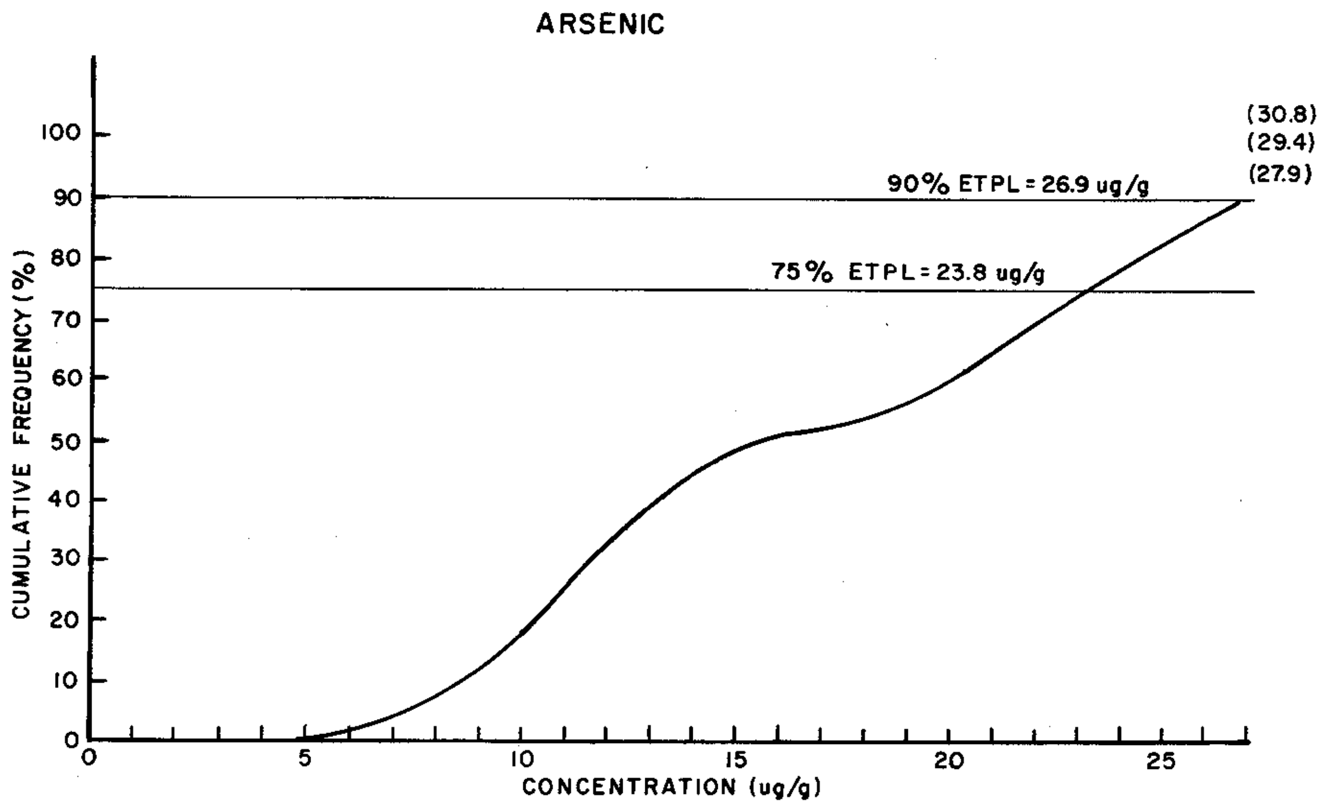

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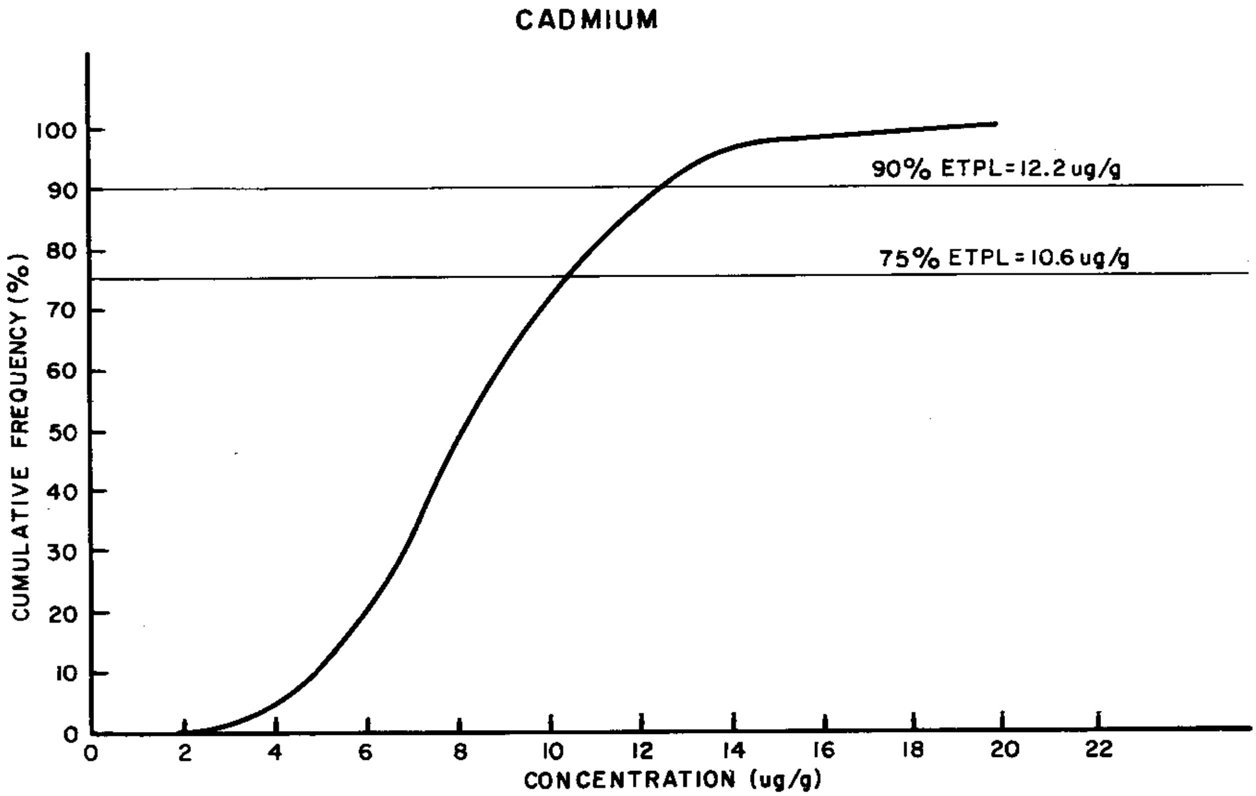

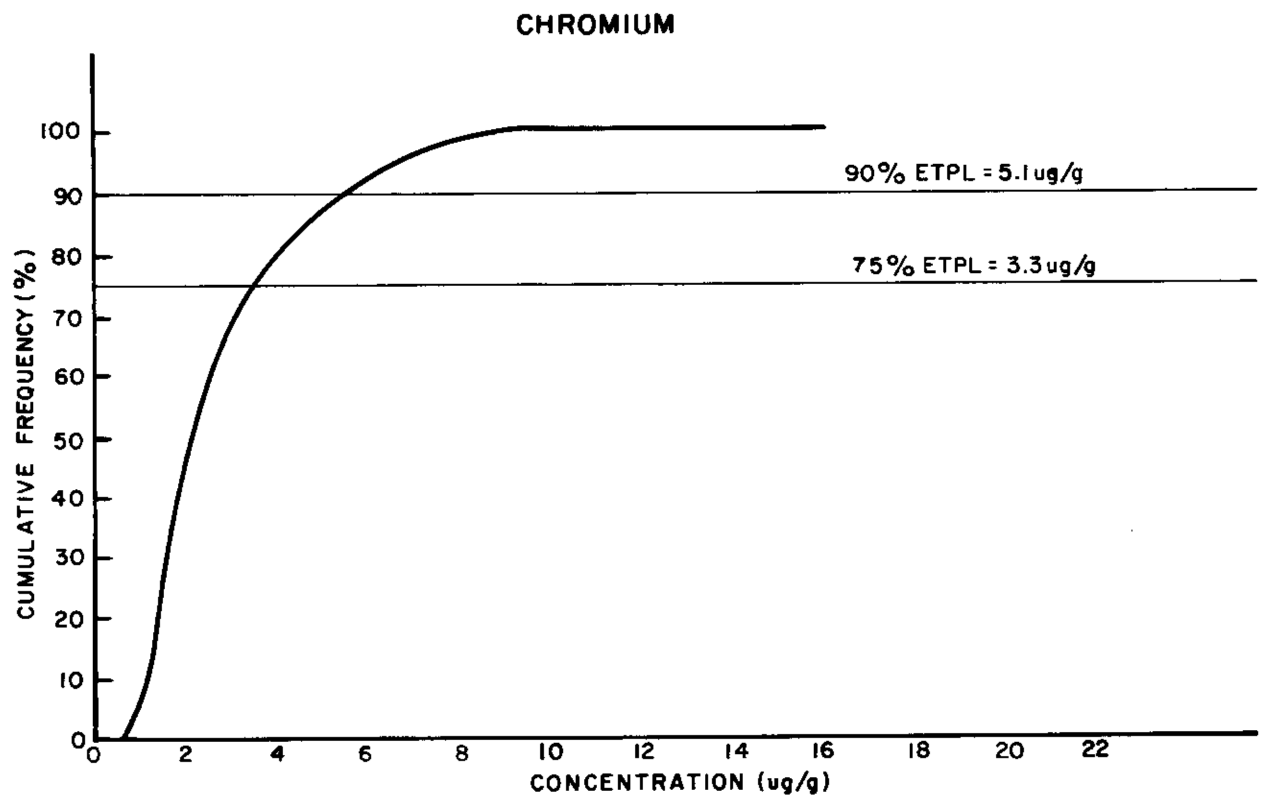

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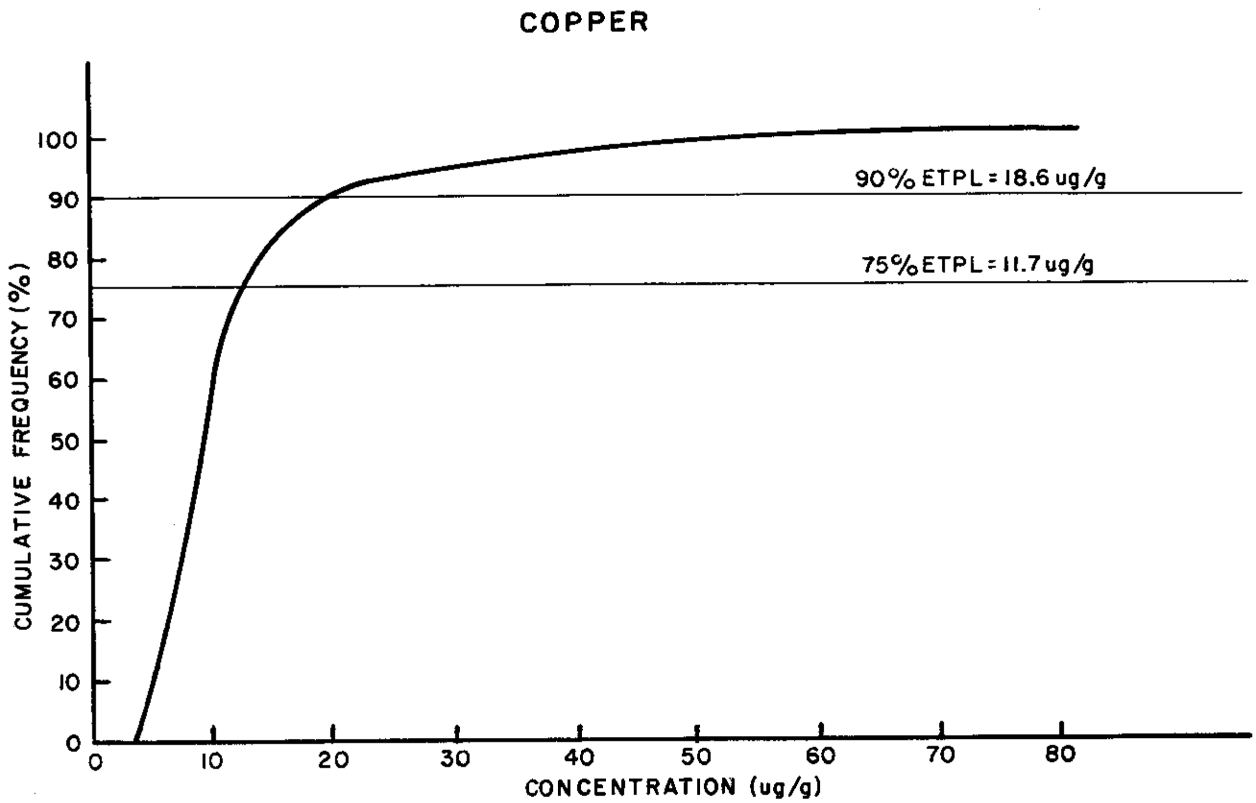

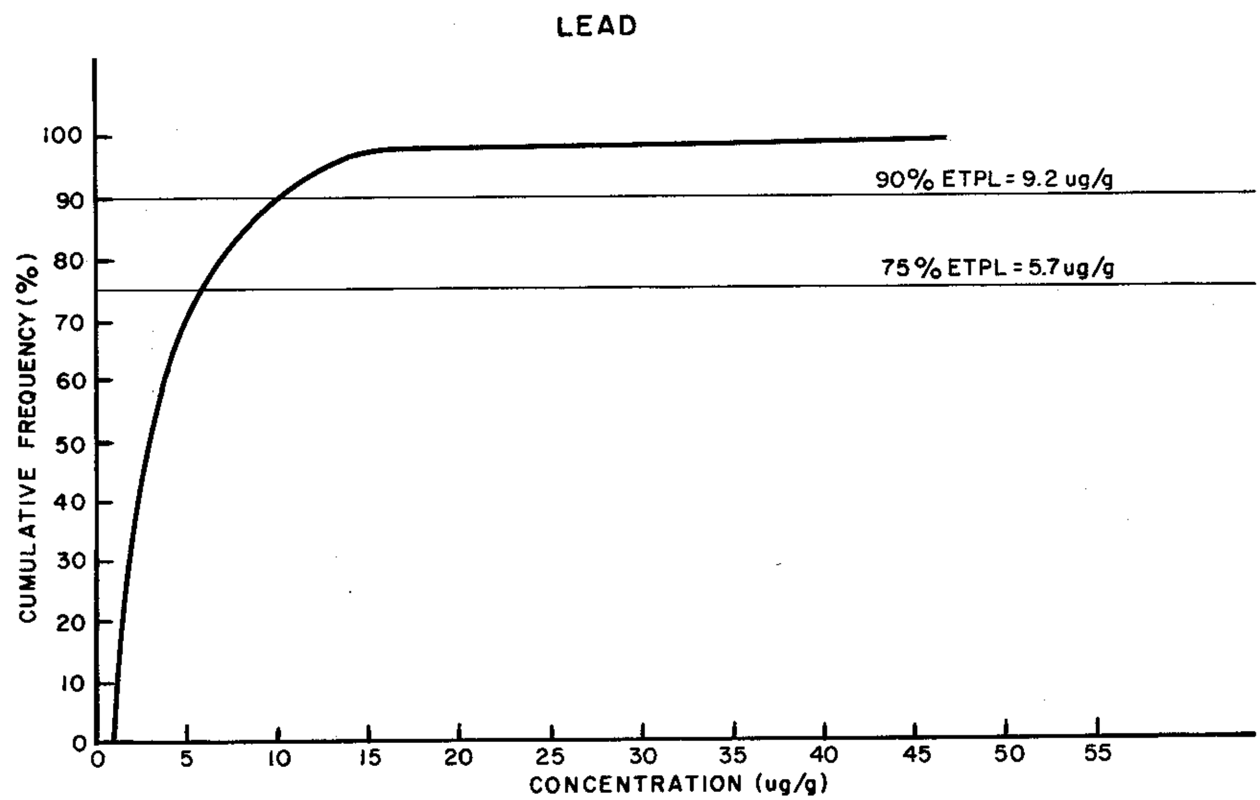

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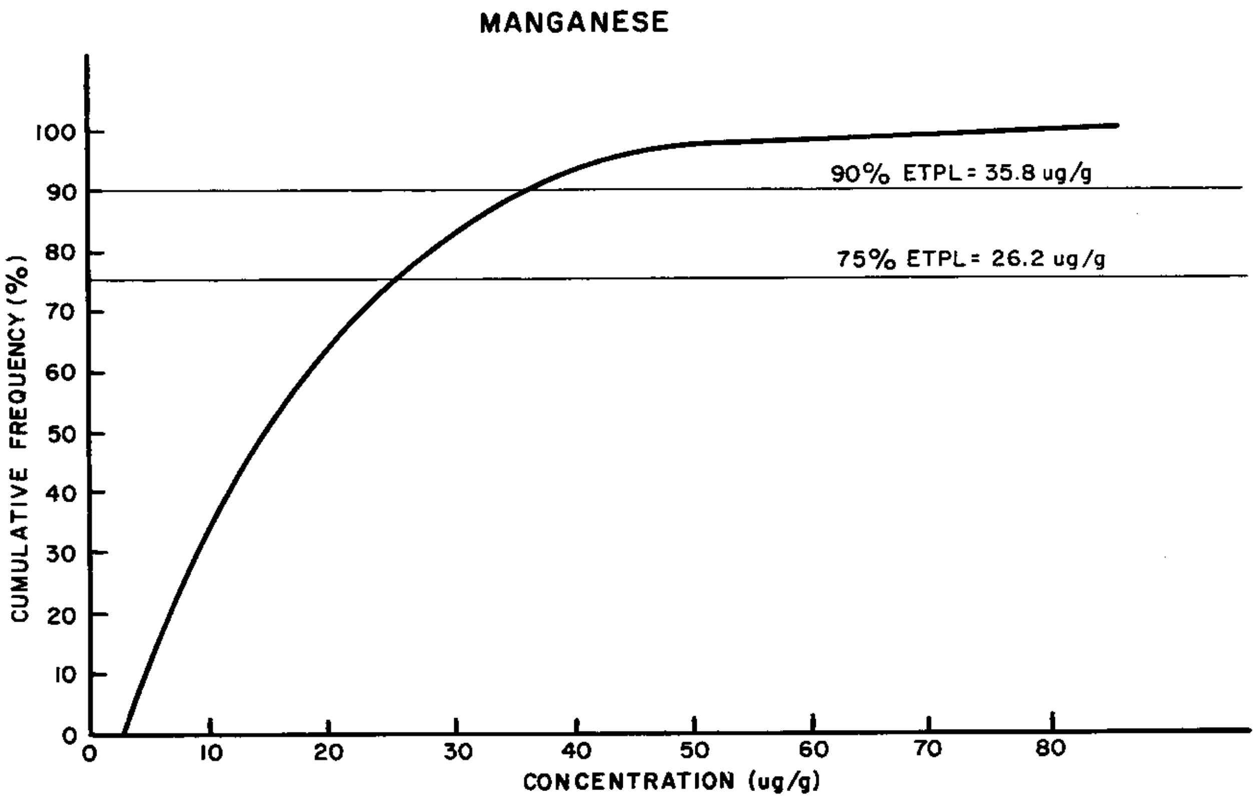

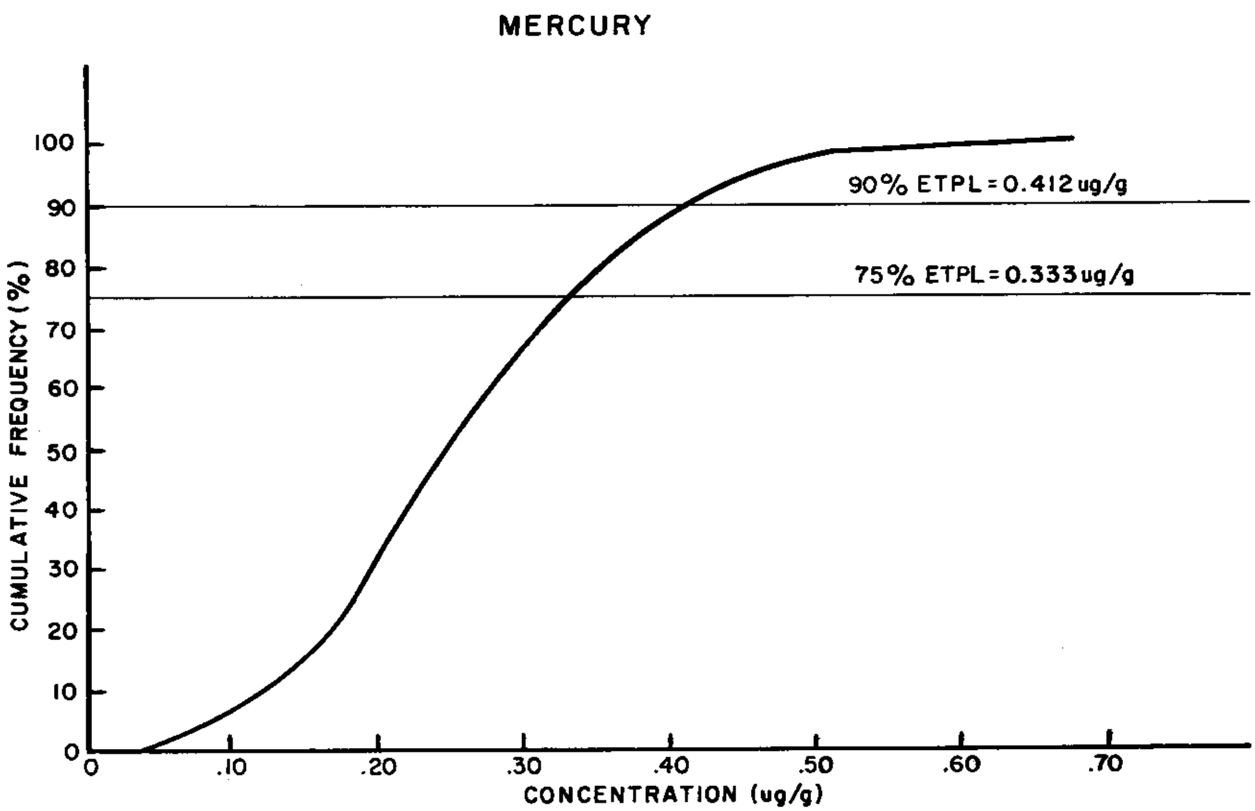

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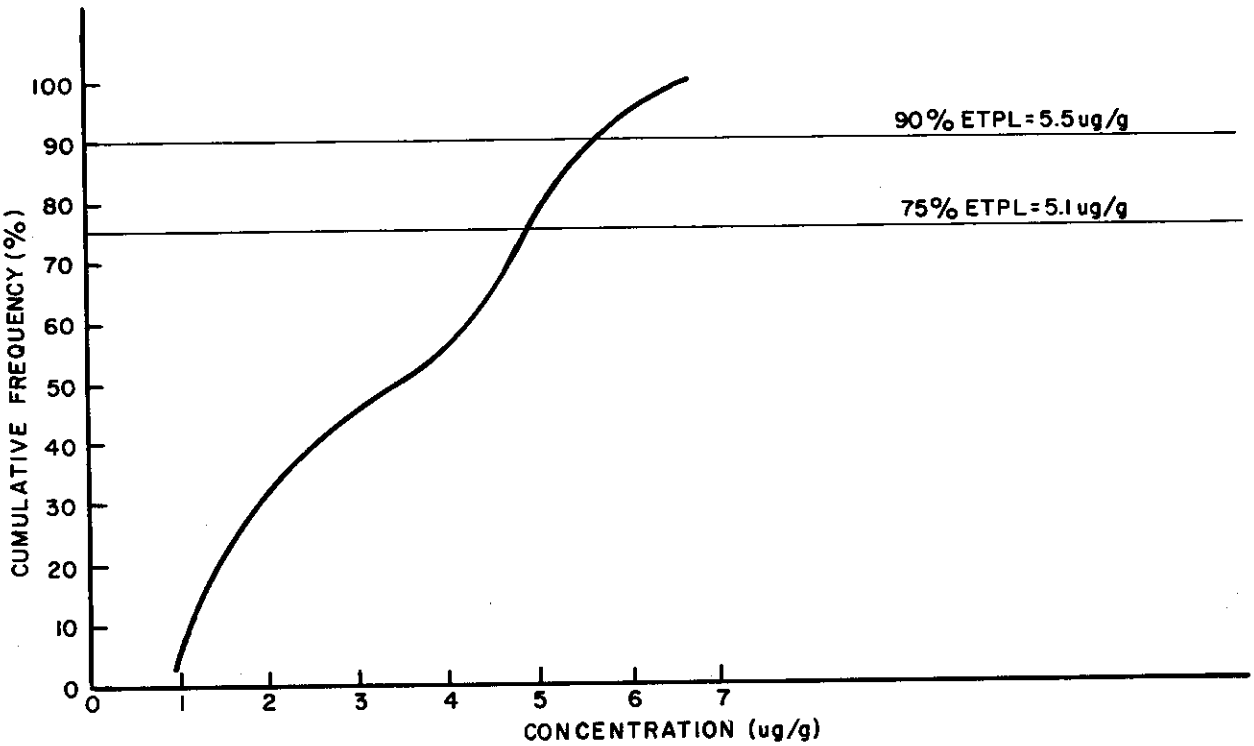

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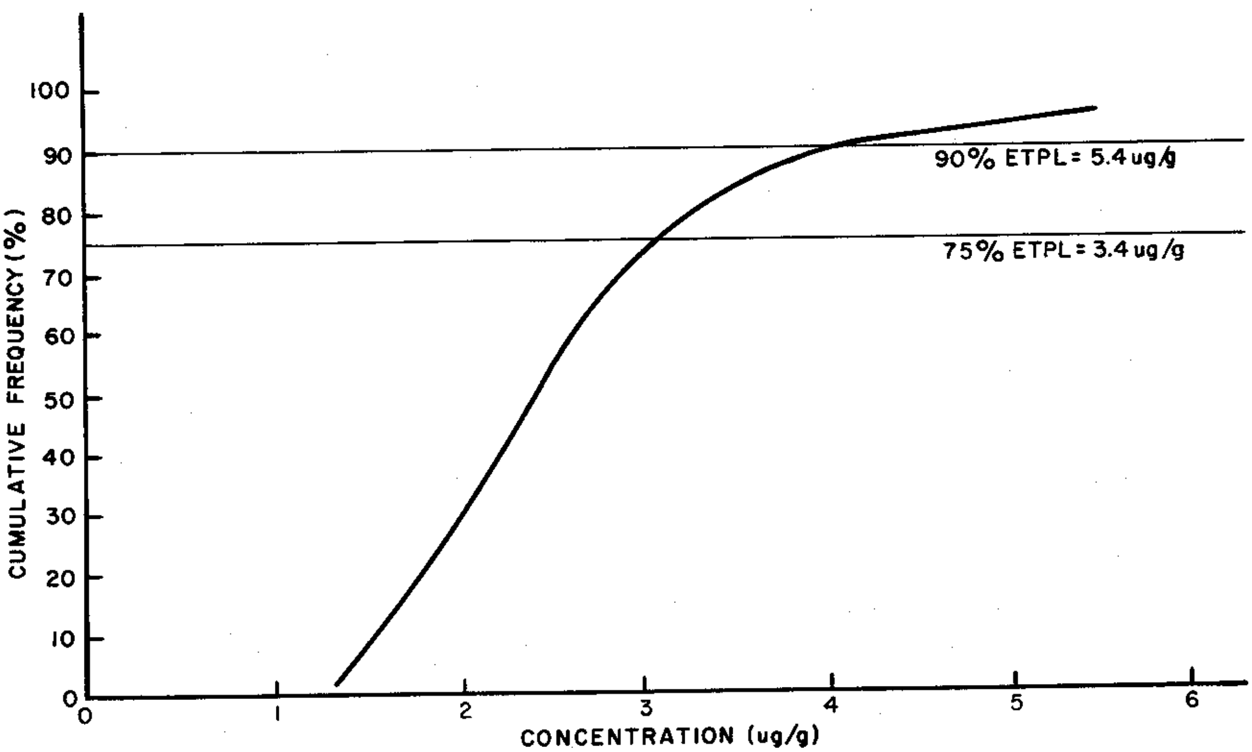

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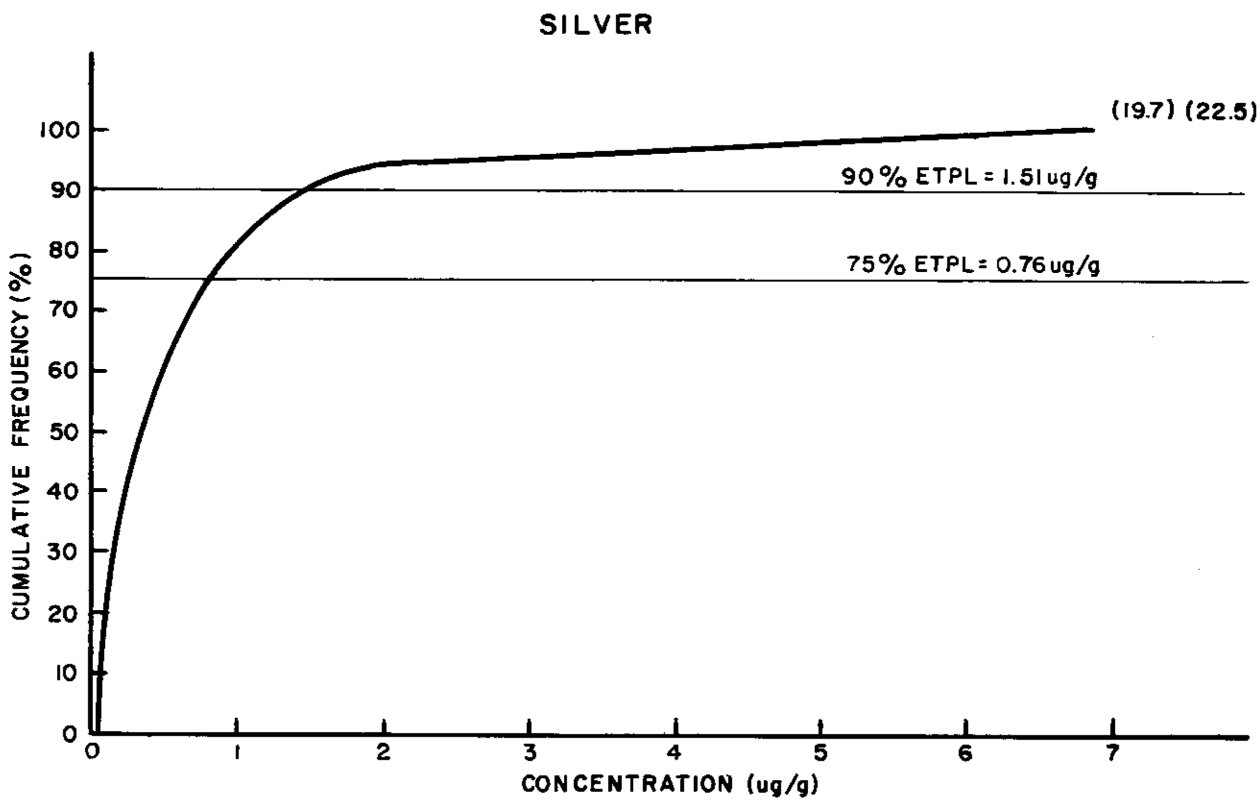

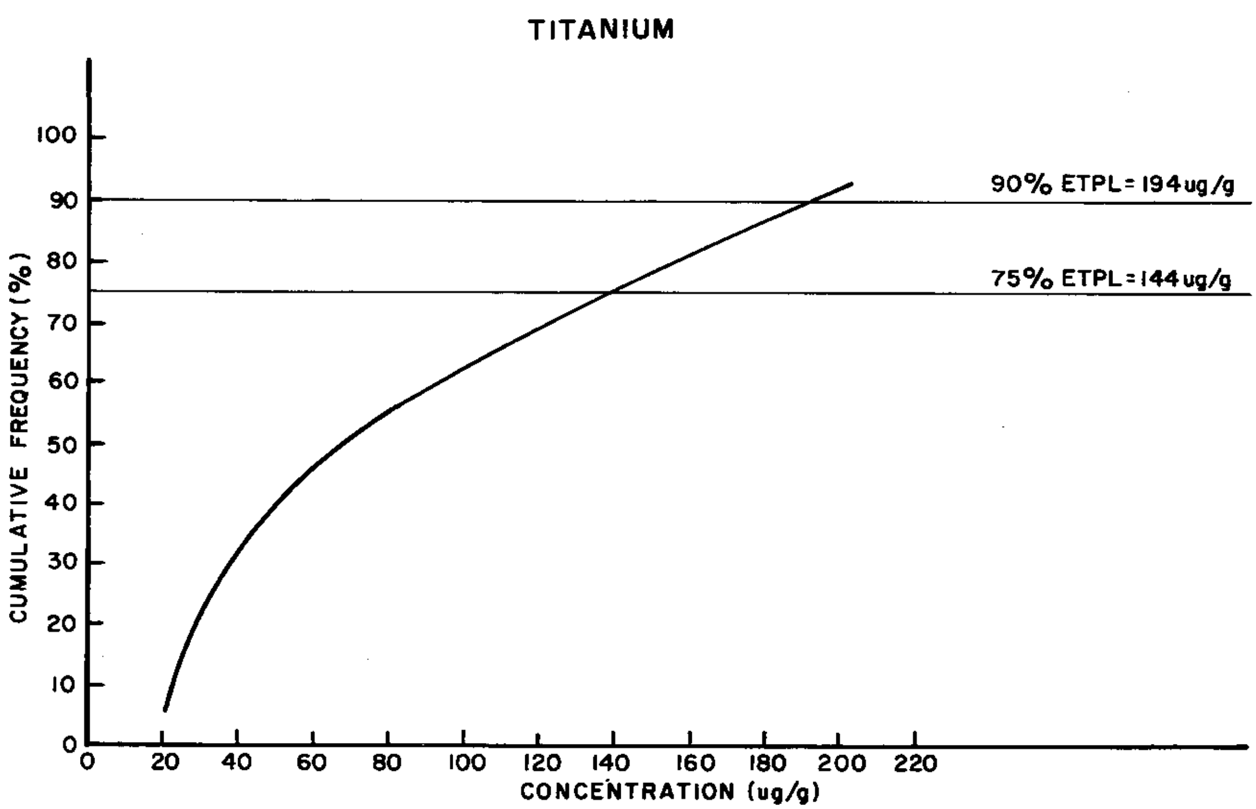

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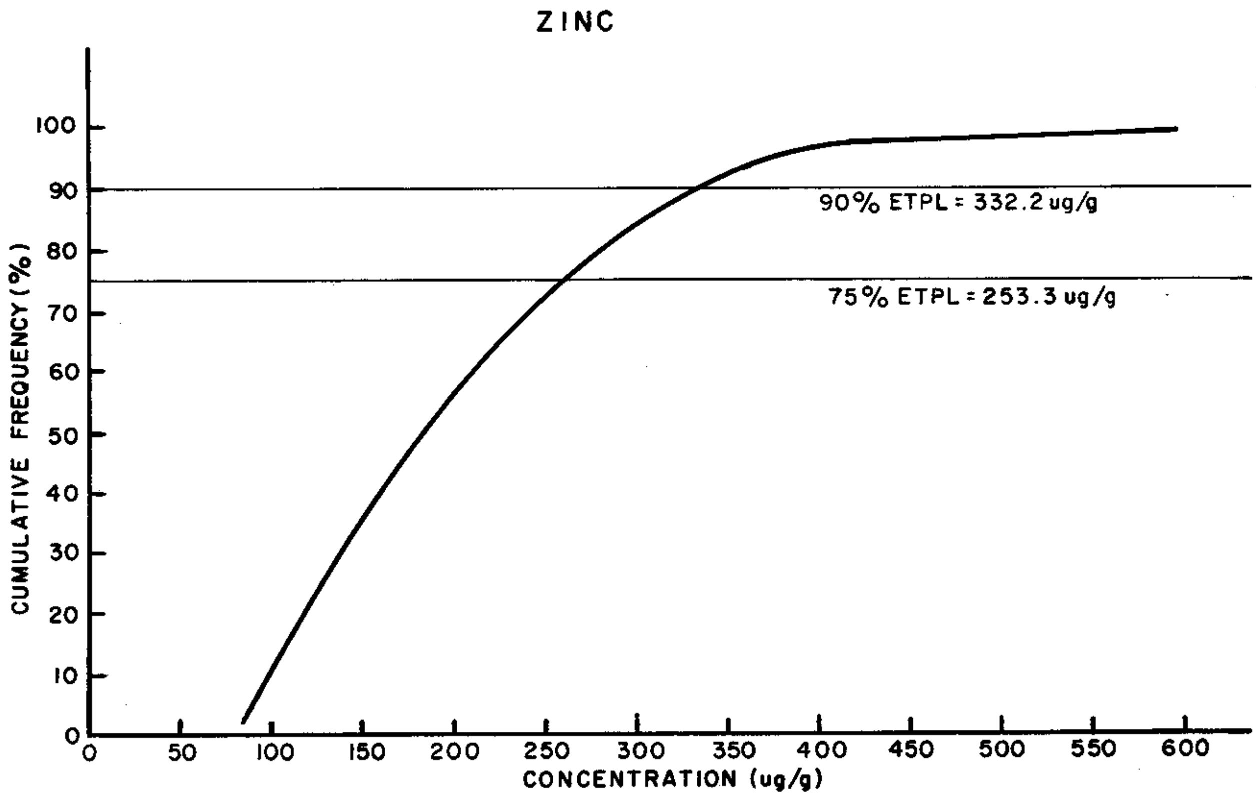

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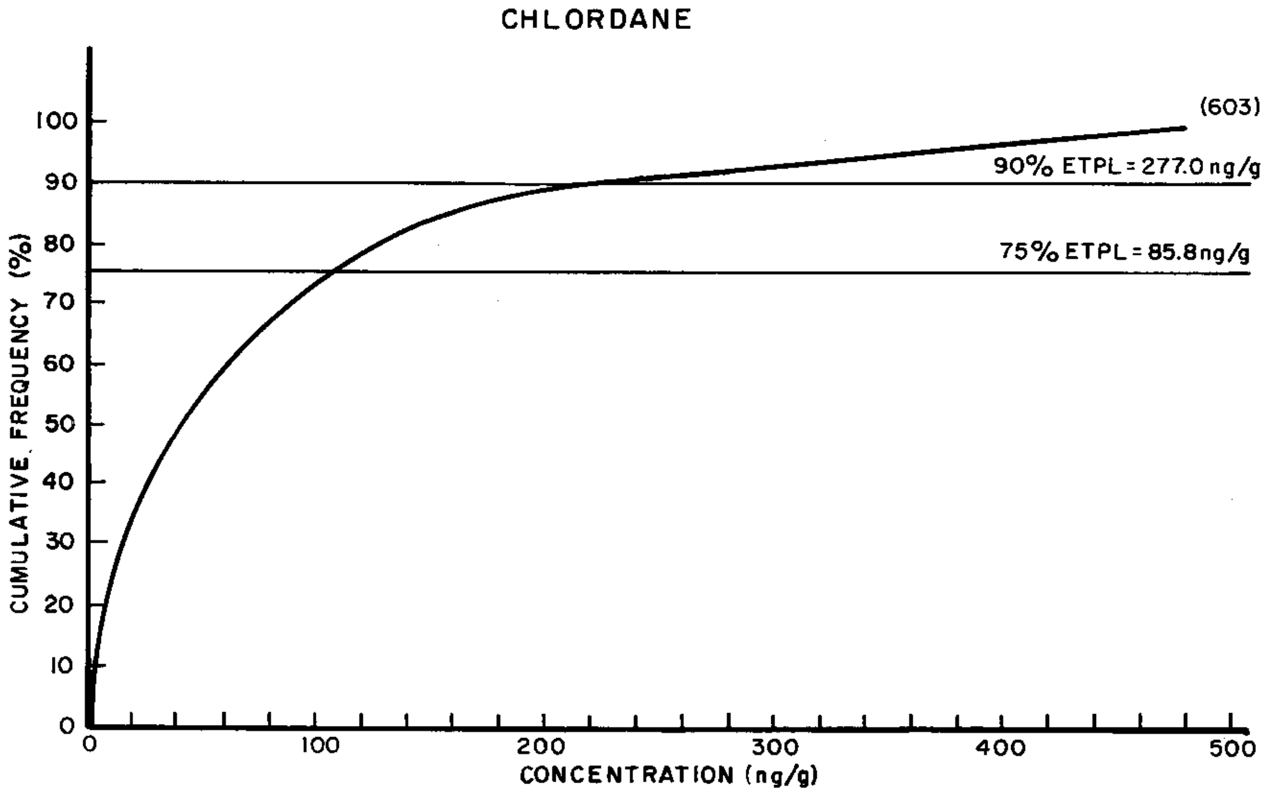

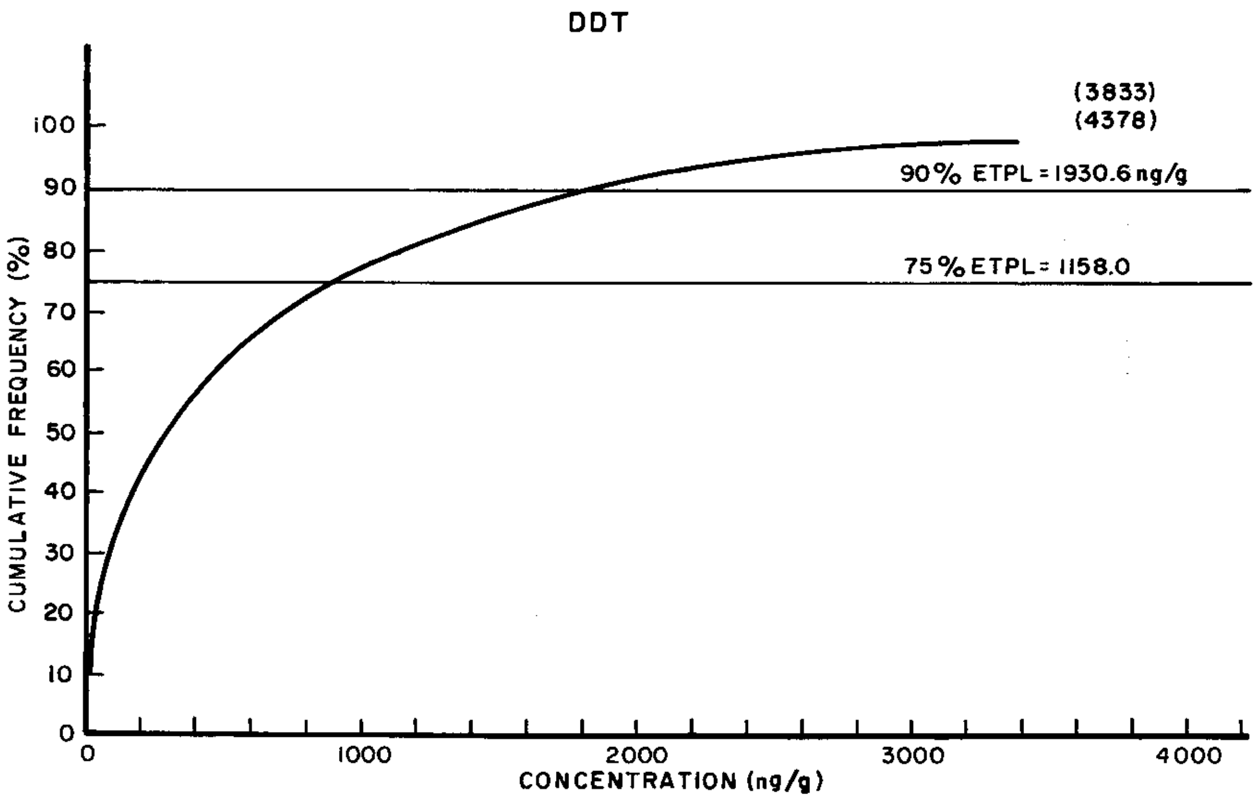

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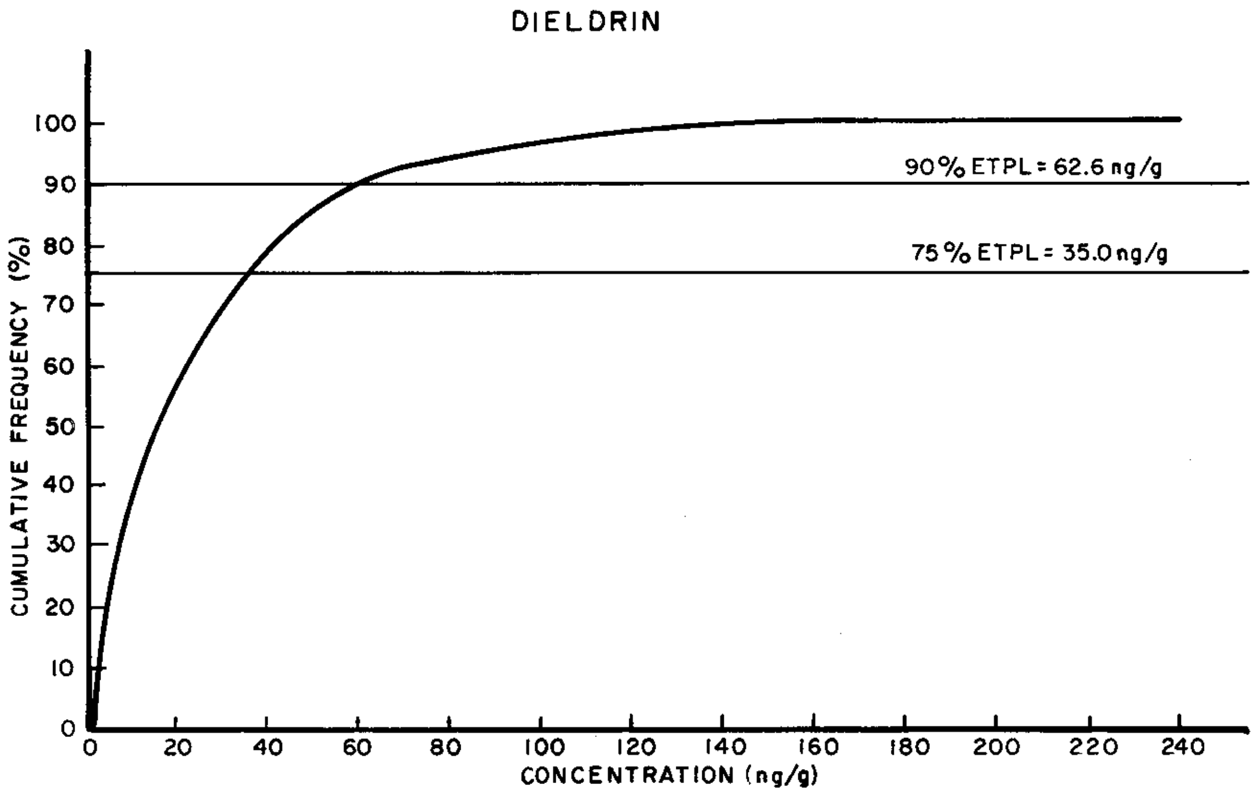

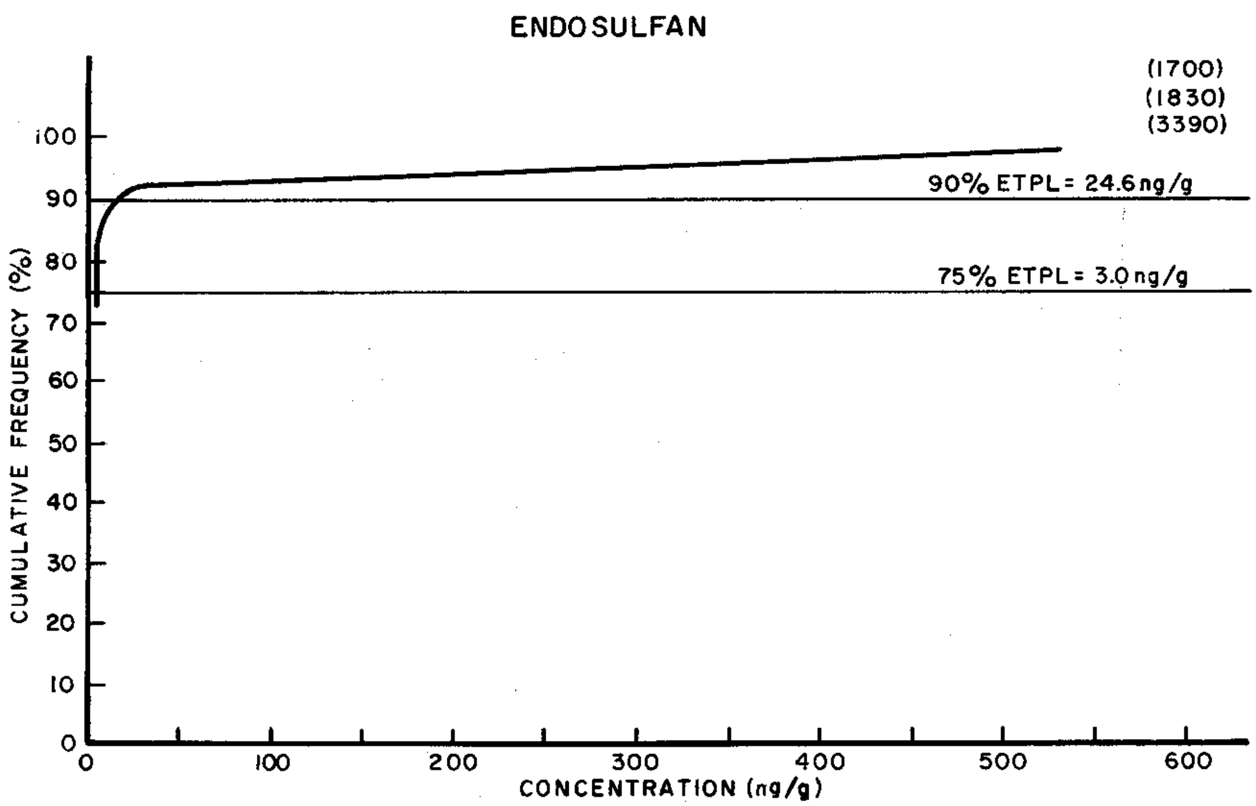

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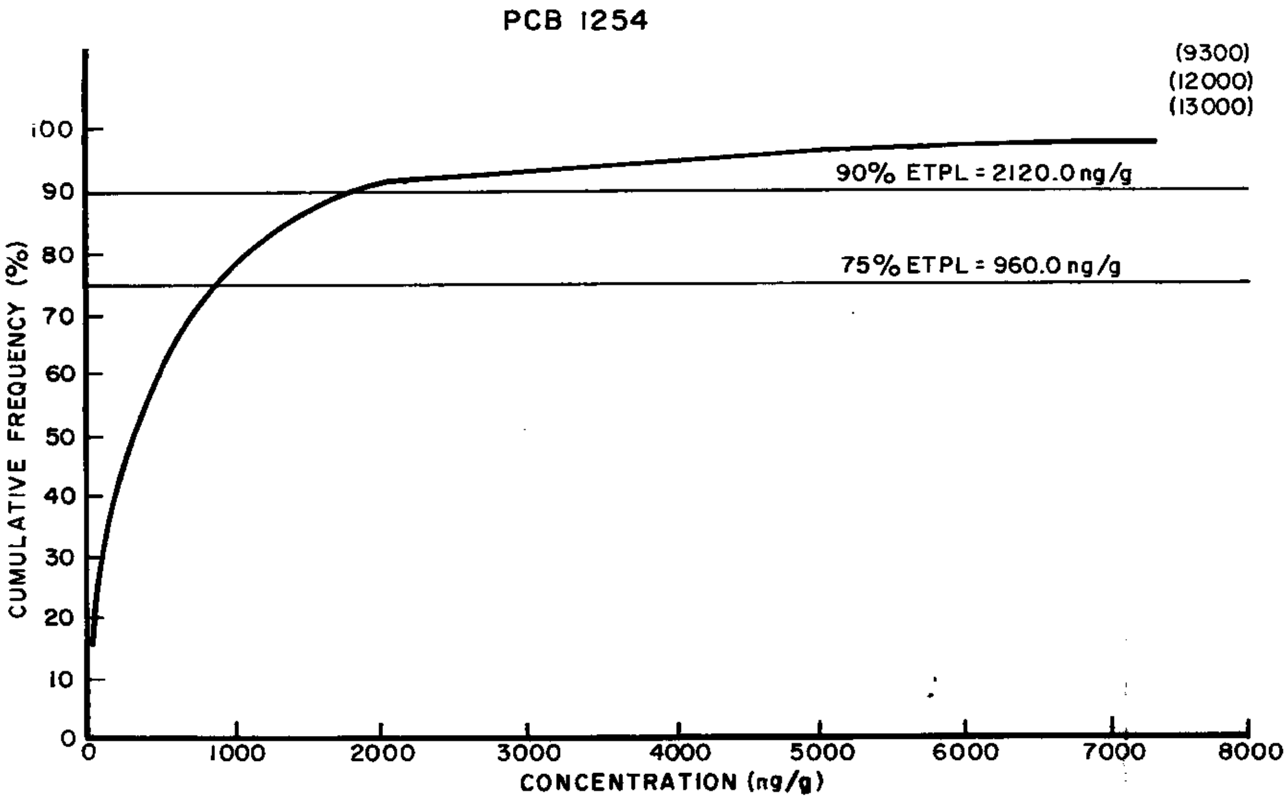

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